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TASMANIA.

REPORT

OF THE

SECRETARY OF MINES

FOR

1890-91,

INCLUDING INSPECTOR OF MINES' REPORT.

Tasmania:
WILLIAM THOMAS STRUTT, GOVERNMENT PRINTER, HOBART.
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PARLIAMENT OF TASMANIA.

REPORT OF THE SECRETARY OF MINES FOR 1890-91 :

INCLUDING INSPECTOR OF MINES' REPORT.

Presented to both Houses of Parliament by His Excellency's Command.

5/-

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REPORT OF THE SECRETARY OF MINES.

Office of Mines, Hobart, 31*st July,* 1891.

Sir,

I have the honor to submit my Report upon the Mines Branch of the Lands and Works Department, for the year ending 30th June, 1891.

Appendices.

Appended will be found Reports of the various Commissioners upon the state of the mining industry in the divisions under their charge; the Report of the Inspector of Mines; the Annual Report of the Geological Surveyor; the Report of the Mount Cameron Water-race Board; Reports by the Geological Surveyor upon the Spring Bay Coal, the Hydraulic Limestones at Maria Island, the Mount Zeehan and Mount Dundas Silver Lead Fields, the Beaconsfield Gold Fields, and the Tin-bearing Gravels of the Gladstone District, with Notes upon Hydraulic Elevators; Returns of the operations of the Diamond Drills, with tables showing the yields of Gold, Tin, and Coal; the number of persons engaged in mining; the number of Leases and area of land held for mining purposes; the net Revenue paid to the Treasury from Mines, with the amount of Dividend Tax paid by Mining Companies.

General remarks.

At no previous period in the history of the Colony has the mining industry presented a more hopeful aspect than at present. The silver discoveries at Zeehan and Dundas, which are, undoubtedly, of vast extent and richness, have led to discoveries, not only of silver, but of gold and other metals and minerals in various parts of the Colony. Attention has been attracted to and capital invested in the development of the mineral wealth of Tasmania to an extent not likely to be dreamt of by the most sanguine, although, as will be seen later in this Report, the yields of metals and minerals during the past year, with the exception of coal, show a falling off. This must not be taken as any indication of a decadence in the mining industry, for the reasons for such falling off are explainable in every instance. The development of the silver deposits, situated as they are in wild mountainous trackless country, subject to an exceptionally heavy rainfall, is, necessarily, a matter requiring time; but, so far as the fields of Zeehan and Dundas are concerned, active preparation is being made for the near approaching completion of the railway, which will afford means of transporting machinery to the field and ore therefrom; and it is no idle prediction to assert that the immediate wealth of these two fields alone will go far to revolutionise the Colony at no distant date.

During the year discoveries of gold at the Ring River, some ten miles north east of Dundas, of silver at the Savage River, the Vale of Belvoir, the Dial Range, and at Mount Field West, all of considerable importance, have been made, whilst other discoveries, of present lesser importance, of gold, tin, and silver, have been reported in various localities. Some of the older established gold and tin fields are also affording satisfactory evidence of revival.

A most gratifying proof of confidence in the mineral wealth of the Colony is afforded by the large amount of foreign capital which is being invested in mining ventures, and in railways, harbour works, and other projects connected therewith.

Gold.

The yield of gold for the year has been 20,000 ounces, as against 29,240 ounces for the previous year. This falling off is due to the suspension of operations at the principal mine at Beaconsfield during the erection of more extensive pumping appliances, and to no other cause. Some of the old established fields are giving promise of revival, notably Lefroy and Mathinna. At the former place the yield for the year has nearly doubled that for the preceding year, whilst at Mathinna steady development is taking place; the leading mine—the New Golden Gate—has yielded 7304 ounces of gold during the year, and, besides having added considerably to its plant, has been enabled to pay £9600 in dividends. Discoveries of some importance have been made at the Ring River, about ten miles from the Dundas silver-field, at the Savage River, and at other localities deposits of less present importance have been found.

Silver.

The Mount Zeehan field is steadily developing. Active operations are proceeding in all parts. The work of shaft-sinking, construction of tramways, and general preparation for the large output of ore which will assuredly take place upon the completion of the railway, is proceeding with vigour. The only mine which has exported ore to any great extent is the Silver Queen, which, during the last half-year has (at heavy cost for transit) exported 994 tons, yielding net returns of £18,570, and has been enabled to pay £8640 in dividends.

A population of some 2500 persons is already located at Zeehan. The town contains some fine buildings, and is assuming considerable proportions.

Dundas, owing to difficulties of transit, has, as yet, exported no quantity of ore. The development there has been very extensive. The early completion of the Zeehan-Dundas branch railway will enable the admittedly rich ore deposits of this locality to find their way to market in vast quantities. A town is rising up here also; and ere twelve months have passed, the towns of Zeehan and Dundas will be connected by settlement all along the route, and a very large population will be settled there. During the year new finds have been made, extending from Dundas northerly about ten miles to the Pieman River; north-easterly about ten miles to Mount Read; and south-easterly about a like distance to Mount Tyndall.

The total area of ground taken up for mining purposes at and around Zeehan and Dundas amounts to 87,000 acres.

Heazlewood and Whyte River.—These fields, hitherto retarded for want of a road, are developing steadily; and, with the completion of the road and the Godkin tramway, much progress will be made during the coming summer. A bulk test of some 27 tons of ore from the Godkin mine yielded 2763 ounces of silver, or an average of 102 ounces per ton..

Extensive finds have been made during the year, notably at the Savage and Whyte Rivers, at Waratah, at the Dial Range, at the Vale of Belvoir, at Mount Claude, at the Florentine: and, coming nearer Hobart, at Mount Field West and at the Dromedary, besides other localities.

The area of new ground taken up during the year for silver mining purposes is 81,851 acres.

Tin.

The yield for the year has been only 4783 tons, as against 5074 tons for the corresponding period in last year. This falling off is due mainly to the drawing off of large numbers of miners to the more attractive silverfields, but partly also to the fact that considerable areas of alluvial tin ground in the Eastern and North-eastern Divisions is worked out. Lode tin mining is just now attracting some attention. In the Eastern Division discoveries are reported which, if they come within measurable distance of their reputed wealth, will very shortly give highly satisfactory results.

Coal.

The output of coal for the year has been 51,593 tons, being an increase of 11,000 tons on the year. A considerable development has taken place in the Mersey District. The output from this locality during the year has been 5026 tons.

A large amount of prospecting for coal by means of diamond drills and otherwise has taken place at the Mersey, at Spring Bay, at Macquarie Plains, at Langloh, near Hamilton, and at the Henty, in close proximity to the Strahan-Zeehan Railway. The prospects are encouraging, but further time is required to prove results.

Iron.

A considerable deposit of iron ore is being developed with much energy, near the Blythe River. The quantity is undeniable, whilst the published analyses and tests are highly satisfactory.

Other metals and minerals.

There have not been any very important discoveries or developments of these during the year.

Evidences of activity.

During the year ending 1st July inst., 488 leases for 25,000 acres of land, have been issued, and 1830 applications, for 97,000 acres, are in process of being dealt with, besides a large number of grants of water rights and mining easements.

Areas leased and applied for.

The areas leased and applied for are as follows:—

	Acres.
For Gold	7700
Silver	119,000
Tin	32,000
Coal	13,000
Other minerals	4000
Total	175,700

against 70,795 acres on 30th June, 1890.

The Revenue.

The revenue for the year for rents, application fees, licences, miners' rights, &c., amounted to £35,942, or an increase of £16,745 for the year; no account being here taken of large sums received by the Treasurer, but not credited to this Department, for stamp duties upon the registration of mining companies, transfers of mining leases, dividend tax, and other items incidental to mining.

Mining Companies.

During the year 164 mining companies have been registered, with an aggregate capital of £1,062,000.

Division of the Colony.

For departmental convenience the Colony is divided into Districts, as follows:—The Northern and Southern, comprising the country on the right and left banks of the River Tamar as far west as the River Forth, and on the east to the Scottsdale District, with such mineral country as there is in the southern portion of the Colony, and includes the gold-fields of Beaconsfield, Lefroy, and Lisle. The North-Eastern District comprises the whole of the north-eastern country, including several important tin-fields, with the gold-fields of Mount Victoria and Waterhouse. The Eastern District comprises the eastern portion of the Colony, and includes the tin-mining centres at Ben Lomond, Weldborough, and Gould's Country, with the extensive coal-bearing country around Fingal and Seymour, and the gold-fields at Mangana and Mathinna. The Western District embraces the wide area of country extending from the River Forth northwards, southwards, and westwards to the sea; it includes the celebrated tin-mines at Mount Bischoff, an extensive area of tin-bearing country at Heemskirk, the silver-fields at Mount Zeehan, Mount Dundas, and Heazlewood, the gold-field at the Linda, and other more or less important mining centres.

Departmental Staff.

With the accession of work the staff at the Hobart office has somewhat increased, but the pressure is great, and increased assistance and office accommodation is required. At the Launceston branch an amalgamation of offices has involved some redistribution of the work. It is with very extreme regret that I have to record the untimely decease of the late Registrar, Mr. Percy Smith, an experienced and valued officer, who held and deserved the entire confidence of his superior officers and of the mining community. His loss to the department will be difficult to repair.

The Inspector of Mines.

The report of this officer is annexed. It is noted with regret that the number of fatal accidents for the year is unusually large.

The Geological Surveyor.

Valuable reports from this officer upon various portions of the Colony which he has visited during the year, are, in addition to his annual report, annexed hereto.

Diamond Drill.

Two drills only are kept by the Government. Both have been working throughout the year. The results are annexed to this Report.

Deep-sinking Vote.

One company only is employed in expending the balance available upon this vote. Hitherto its operations have been unsuccessful, but of late it is reported that some gold-bearing leaders have been struck, which give hope that the expenditure will be justified by the results.

Mount Cameron Water-race.

The Report of the Board which has the management and control of this Race will be found annexed to this Report, and is of an encouraging character.

I have the honor to be,
Sir,
Your very obedient servant,
F. BELSTEAD, *Secretary of Mines.*

The Hon. the Minister of Lands and Works.

REPORTS OF COMMISSIONERS.

Northern and Southern Division.

Mr. Commissioner Glover, in charge of this Division, reports:—

"In reviewing the mining industry in this division during the past twelve months, I have at length the satisfaction of reporting the existence of fair indications of the coming fulfilment of some, at any rate, of the hopes and expectations of the past.

Beaconsfield.

"Hitherto the Tasmania Reef at Beaconsfield constituted the most important factor in the gold yield of the Colony; and when the richest levels were reached in the works on that reef, the constantly recurring obstruction from subterraneous water became insurmountable with the dresent appliances in use, and the miners being then driven out of the proper workings, the necessary consequence was that only a very limited amount of mining could be accomplished, and this in the all but worn-out upper levels; hence the serious apparent failure of the gold yield for many months past. The only effective remedy was the acquisition of sufficiently powerful machinery from England, the sinking of a new main shaft, and other appliances of equal magnitude. These requirements have been almost completed, though not yet ready for work; but within the past two months, by temporary improvement and expedients with regard to the existing appliances, the rich lower levels were occasionally reached and mining carried on, though for very short periods. These occasional opportunities for the due progressive working of the mines, intermittent and desultory as they were, have resulted in a remarkable increase of yield. This will be apparent on reference to the yields of the first three quarters of the past twelve months—namely, 835 oz., 402 oz., 140 oz. respectively—whilst the quantity for the last quarter to the 30th June, owing to the occasional access gained to the lower levels, amounted to 5201 oz. The extraordinary apparent depression, therefore, in the yield of gold for the long previous period was not due, as supposed by many, to any failure of the gold resources of Beaconsfield, but to the fact that the progressive works on the Tasmania Reef were temporarily almost stopped pending the acquisition and erection of adequate machinery. The other undertakings at Beaconsfield are proceeding with more or less activity, whilst others, in which reefs have been struck, are suspended whilst further capital is being sought. The enterprise of exploring and proving the deep ground at the base of Cabbage Tree Hill by a Victorian syndicate is proceeding steadily, though some considerable time must elapse and much expenditure be incurred before any definite result can be realized; and a second Ballarat syndicate has recently initiated another similar enterprise on the same lead.

Lefroy.

"At Lefroy the discovery of a payable claim on the line of reef known as the "Pinafore," which yielded, from a crushing of 477 tons of quartz, 638 ounces of gold, has given a great impulse to enterprise on that field, and several claims on the same line of reef have been taken up. Some indication of the value of the discovery may be afforded by the circumstance that the progressive yield of this mine for the last two quarters was 345 and 938 ounces respectively. It has also proved a stimulus to many prospectors who are now engaged in the search for new discoveries.

Denison and Golconda.

"At the Denison and Golconda a remarkable revival of mining activity has recently taken place, in consequence of the discovery of reported rich reefs at each of those localities. Especially one at the former place is reported to be exceptionally rich, and foreign capital is engaged in its development, and machinery is being conveyed thither for that purpose. Under the stimulus thus given, there are also many persons engaged in prospecting throughout the locality.

Lisle.

"At Lisle about forty men still find sufficient inducement to continue in the pursuit of gold-digging, and the estimated quantity obtained has been 1000 ounces for the year.

Middlesex.

"At Middlesex Plains there is nothing worthy of mention, as no new developments have taken place. The want of water has, until very recently, prevented diggers from any work other than "stacking" wash stuff, ready for treatment when water shall be available.

Mersey District.

Norwich.

"The quantity of coal raised at the Dulverton aud Railton Collieries for the last quarter was 2650 tons, and the quantity for the whole twelve months was 6358 tons. The yield of the comparatively small coal-mining operation at Norwich was, for the last quarter, 500 tons.

Diamond Drills.

"During the year, from 21st April to 31st October, 1890, No. 1 diamond drill was employed by a company in searching for an eastern extension of the Tasmania Reef at Beaconsfield. The operation was confined to one bore, which reached a depth of 979 feet, the last 517 feet being through solid limestone rock, when the work was abandoned. The cost of this bore was a small fraction over 14*s.* 9*d.* per foot. The same drill was again engaged from the 25th February last in boring for coal at Spring Bay, in which work it is still engaged, having accomplished, in three bores, 156 feet, 76 feet, and 424 feet respectively, and it is now proceeding with a fourth bore on the same locality. No. 2 drill has been employed in boring for coal at Macquarie Plains since 19th February last, and has finished one bore of 643 feet unsuccessfully; and it is now engaged in a second bore.

North-Eastern Division.

Mr. Commissioner O'Reilly thus writes as to the Division under his charge:—

Gold.

"During the period since my last Annual Report, gold mining operations have been very limited,—principally confined to prospecting for remunerative quartz reefs; and a fair amount of legitimate work has been done in this way, with encouraging results.

Mount Victoria.

"At Mount Victoria preliminary work is still being carried on by the Mount Victoria Gold Mining Company, in driving for the reef. This is the only claim that has been constantly mined at this place

"Very satisfactory results followed from a trial crushing of quartz made by the Strahan Company,—five tons of stone having yielded eight ounces of gold; but this encouraging result has not been followed up by the further development of the claim.

Waterhouse.

"At Waterhouse the prospecting operations referred to in my last report have been successfully carried on; and I am informed that a new battery will shortly be erected by a Melbourne Company, on the Southern Cross claim.

"There has recently been a considerable extent of increased interest taken in the gold-bearing reefs in several localities in this district; and there is reason to hope that during the next twelve months a large amount of work will be done in prospecting and mining operations, and thus increased development made.

Silver.

Silver.

"A discovery of a silver lode, which is reported as very promising, has been made by the Dorset Prospecting Association in the Waterhouse locality, and a reward claim applied for of 80 acres. This discovery was made by a prospector who gained some experience at the West Coast silver fields. I have no doubt, as practical miners who have some knowledge of silver lode formations return here from the West Coast, further discoveries will be made.

Tin.

Upper Cascade and Ringarooma.

"There has been a considerable falling off during the year in the quantity of ore raised in the localities of the Upper Cascade River and Ringarooma, as also in the number of miners, European and Chinese, employed.

"Although there is a considerable extent of mineral-bearing lands, especially in the Mount Maurice locality, the deposits of ore are considered too poor to mine profitably at the present rates ruling for tin.

"I regret to find that no active steps have been taken during the above period to develop the tin lodes known to exist in some few of the claims at the Upper Cascade River; but I trust that during the coming summer months that energy will be displayed in this direction.

Branxhol

"The depression referred to in my last annual Report with regard to this locality still remains, although there are favourable prospects of its partial removal during the coming year. On an average 50 European and 70 Chinese miners have been employed, with an output of about 200 tons of tin ore. I am informed that the principal mine in this locality, the Arba, will in future be mined by European miners, and preparatory work has been here carried on for some time; active mining operations will be resumed in a short time. The prospects of this claim are considered very good. The adjoining claim of the Ormuz T. M. Co., situate in private property, I am also informed, appears promising as to producing satisfactory yields. A considerable extent of preliminary work has been done on this claim, and I understand that machinery will soon be erected for raising the wash.

"There are several small claims in this locality being mined with considerable vigour and enterprise, the yields being remunerative. The Ringarooma Valley T. M. Co. employ 24 European miners, and are carrying on extensive mining operations. The Argyle T. M. Co. have erected pumping machinery, and are with vigour prospecting the tin lode on their claim near Branxholm. The prospects are considered very good.

Brothers' Home and Main Cree

"At Brothers' Home three of the principal claims are now being mined, and employ a large number of European miners. The Briseis Tin Mining Co. have provided, at considerable expense, machinery for removing the overlay of deposit resting on the tin-bearing wash, and have removed a considerable quantity of material in this way, but as yet have not sufficiently advanced with the work to enable the tin ore to be raised. Sixty European miners are employed by this Company on this claim. The adjoining mine of the New Brothers' Home No. 1 Tin Mining Co. has not been mined for some time in consequence of the action at law taken in the Supreme Court by the former Company, which resulted in the Court granting an injunction restraining the latter Company from carrying on mining operations adjoining the boundary line between the two Companies' claims, in which place was found the richest deposit of tin on the latter Company's mine. The stoppage of works in this mine has caused much depression in business in the locality, as a large number of miners were usually employed. The Triangle and North Brothers' Home Tin Mining Co. have erected machinery for raising the wash-dirt in the usual manner, and will soon be in a position to produce an output of tin ore with very favourable prospects of success. There are several small claims being mined in the locality of Main Creek, the returns from which appear satisfactory.

Moorina.

"There are not many claims being mined in the Moorina locality, beyond a few at Frome and Weld Rivers and O.K. Creek, in all of which the prospects are considered good, and the returns remunerative.

Bradshaw Creek and Wyniford River.

"At Bradshaw's Creek the Pioneer Tin Mining Co.'s Mine has been worked on tribute by a party of about 25 Chinese, and the quantity of tin ore raised, considering the scarcity of water in the dry season—73 tons—is very satisfactory. I am informed that this Company are about having constructed, at a cost of £1000, a water-race from the locality of the O.K. Creek to their mine, which, when completed, the additional supply of water will tend very largely to increase the output of tin from this claim. The returns of tin ore raised from the Argus Tin Mining Co.'s Claim continue good, as also from several claims in this locality, especially the Garibaldi Tin Mining Co.'s Mine, which is now held on tribute by a party of about 35 Chinese, 260 tons of ore having been raised by them during the past twelve months.

Mount Cameron.

"There have been a considerable number of claims mined in the Mount Cameron locality during the past year, and, on the whole (considering the drawbacks incidental to those mines that cannot be supplied with the water from the Government Water-race or the Esk Tin Mining Company during the dry season), the returns are satisfactory. The above Company are now supplying water to claims in the immediate locality of the town of Gladstone that have hitherto remained unmined through the difficulty of obtaining a water supply. Although tin lodes of a promising character have for some time been known to exist, but little has been done towards prospecting them in a practical manner. Recently on the Mount Cameron Tin Mining Co.'s Claim tin-bearing lodes have been found, and it is to be hoped that this Company will put their usual enterprise into the matter, and have them properly prospected.

Mount Horror.

"There are a few tin claims being mined in this locality by Chinese, who appear to be doing fairly well.

Mount Stronach, Scottsdal

"But little has been done here during the past year in the way of mining operations. A local company is now being formed at Scottsdale to mine a claim, which appears promising from the prospecting work already done on it.

Tin ore shipped.

"The total output of tin ore from the North-Eastern District for the year ending 30th June, 1891, amounts to 1655 tons 1 cwt., as against 1921 tons 14 cwt. for the corresponding period of 1890, there being a decrease of 266 tons 13 cwt. This, so far, is the lowest output on record for several years, and I attribute the falling off, in a great measure, to the temporary stoppage of a few of the large claims that have hitherto produced large yields of tin ore, also, to a considerable amount of "dead" or preparatory work being done on others, and the investment of capital in the West Coast mines that hitherto was applied to this district.

Number o miners employed.

"During the past year there were, on average, 262 European and 486 Chinese miners at the mines in this district. A number of European miners and prospectors have left for the West Coast silver fields, and a considerable number of Chinese miners have left for China and Victoria, having succeeded very well at the mines here, and have taken with them considerable sums of money.

General observati

"As the depression referred to in this report with regard to the state of tin mining in this district appears to me of a temporary character only, I see no grounds for departing from the favourable opinion I have hitherto expressed with regard to the progress and permanency of this important industry for many years to come."

Eastern Division.

Tin mining.

Mr. Commissioner Dawson reports:—

"The yield of tin from this division has maintained its average during the year. The anticipated development by the St. Helen's Tin Mining Co. of an extensive area of tin-bearing ground, about six miles from St. Helen's, has not taken place. For some unexplained reason the Company have not so far carried out their water scheme by which alone the ground can be successfully worked; latterly, considerable stir has been produced owing to discoveries of some very promising tin lodes in the vicinity of the Blue Tier Junction. The successful working of the Anchor mine in that locality has given an impetus to prospecting, which, from present appearances, is likely to yield good results.

Gold mining.

"The scene of this industry is at Mangana and Mathinna. At the latter place, the New Golden Gate mine has yielded some 7000 ounces of gold during the year, has added very materially to its plant and workings, and its success has given a great impetus to the work of developing the adjacent mines on the field. The prospects of this field are hopeful in the extreme.

Silver.

"Some discoveries are reported as having lately been made in the Ben Lemond District, but I have as yet no authentic information upon the subject.

Coal.

"The collieries at Mount Nicholas and Cornwall have worked steadily on throughout the year. Their output is gradually increasing.

"The condition of the mining industry in this division is healthy."

North-Western Division.

Mr. Registrar O'Neill reports:—

"During the past half-year the mining industry in this Division has greatly improved, both as regards gold, silver, and tin, and there is every appearance of even greater developments, especially in gold and silver.

Silver.

"At the Godkin Silver Mine, Whyte River, extensive machinery is in course of erection,—in fact, at this date is about finished. This Company has completed three miles of tramway, and is engaged extending the same about six miles further, in the direction of Waratah. A bulk sample of 25 tons was sent away by this company, which gave a very satisfactory return.

"All the other mines in the same locality are in active operation, with every prospect of success.

"Near Waratah (North Valley) a very rich discovery was recently made, and here a track has been cut connecting this property with Waratah, and a tramway will be commenced without delay.

"At the Magnet Range and along the new road from Waratah to Heazlewood apparently rich discoveries have been made.

Gold.

"Extensive operations are going on in the locality of the Savage River, where a rich deposit is believed to exist, as good assays have been obtained from the formation that exists there.

"In alluvial mining very good results have been obtained by the few miners engaged in this work.

Tin.

"The Mount Bischoff Company is turning out about the usual yield, and the North Valley is pushing on with the erection of machinery.

"The Stanhope Tin Mine, which has been idle for some time, is again in work, having been taken in hand by a tributing company.

"There appears to be little doubt that this Division is coming forward rapidly, and business places are being erected in various localities, and population settling in the locality of the various mines."

Western Division.

Zeehan and Dundas.

Mr. Commissioner Fowell reports as follows:—

"The anticipations as to the progress of the District contained in my last yearly Report have been fully carried out by results. The population has increased to a very marked extent, and this is a sure sign of progress. Another feature I have noticed is that miners in employment on the field have brought down their wives and families. A large number of people have settled down in business, and are building substantial houses, with well-stocked shops, all which prove the confidence the present residents on the field have in its permanency.

"There cannot be direct development of the field until the railway is opened and machinery can be obtained. The present difficulties caused by cartage from Trial Harbour not only affects the mining industry, but very materially adds to the cost of everything at Zeehan.

"The rapid increase of population has caused a very large demand for residence areas, and every effort has been made to meet it. The surveyed town of Zeehan has not been settled upon, only one house as yet having been built upon the purchased allotments. The settlement has extended along the main road from the turn-off to the Silver Queen Prospecting Association to the Silver King mine. In view of its becoming a part of the future town, streets have been laid out, and permits have only been granted when the areas applied for have been properly fixed on the Surveyor's plan; this has been strictly carried out to avoid persons taking up areas where the land may be required for streets or public reserves.

"At Mount Dundas a township has been surveyed; the tramway now being constructed will run close to it. Its position is, I believe, the best obtainable in the neighbourhood, the greater part being high land, easy of drainage, and the surveyed available areas are nearly all already occupied by holders of residence licences.

"Prospecting was pushed on vigorously during the summer season; valuable discoveries have been made in the neighbourhood of Mount Tyndall, and also towards Mount Read. From Dundas sections have been applied for in a northerly direction to the Pieman River, and across it for a considerable distance, and there can be now no doubt that the Zeehan and Dundas field will be connected with the Whyte River and Heazlewood discoveries.

"Lately gold has been obtained in small creeks leading into the Ring River, a tributary of the Pieman. I have seen various samples; it looks much water-worn, and is generally found in the fissures and crevices at the bottoms of the creeks. These creeks are reported to take their rise near Mount Murchison, and when the weather allows it there can be no doubt that part of the District will be prospected.

Mount Lyel

"As regards the portion of the district about Mount Lyell, work for a time has been almost, if not quite, discontinued. The Mount Lyell Company are taking measures whereby their mine may be more thoroughly worked. Several alluvial claims are likely to be united and worked by a Company, and, consequently, this portion of the Western Mining District may soon be expected to take the position so long looked forward to.

"So far as the general work on the field has been carried out during the past year, I am of opinion that as much has been done as could reasonably be expected. The claims particularly worthy of notice are the Silver Queen, Silver King, Mount Zeehan (Tasmania) Silver and Lead Mining Company, Mount Zeehan, and Balstrups; these claims have worked steadily on.

"The mines at Dundas have also been vigorously prospected, and up to present date fully realise expectations. The permanency and future cannot now be doubtful. As before stated, the railway is urgently required for further development, and that may now be confidently looked forward to as completed at the close of the present year or early during the coming one.

"It is also self-evident that Strahan must be the port for the silver field, and also the whole district; therefore the deepening of the bar will be an imperative necessity, and the sooner decided measures are taken in the matter the greater will be the advantage to the district and the colony at large."

ANNUAL REPORT OF THE INSPECTOR OF MINES.

Sir,

I have the honor to forward to you my Annual Report on the working of "The Regulation of Mines Act, 1881," for the year ending 30th June, 1891.

Mining Accidents.—Though the total number of accidents in mines has been greater than last year—27 persons being hurt, as against 15 for the year ending 30th June, 1890,—the number of serious cases has, fortunately, been comparatively small, the injuries received in 17 instances being only of a trifling nature, and causing but a few days' loss of work. Of the remaining 10 cases, 4 were attended with somewhat serious injuries, though none very dangerous or such as to maim the men permanently, and six were, unfortunately, fatal. Of the persons killed, two were Europeans and four Chinese, and of those injured, 20 were Europeans and one a Chinese.

The causes of accident were as follow:—

(1.) *Explosions of Dynamite and Gunpowder.*—Four accidents occurred from explosions, resulting in injuries to eight persons, three of whom were killed by one explosion. These three were members of a Chinese contract party engaged under their own head man in blasting a tail-race in the Weld claim, near Moorina. The nights being very frosty their dynamite, of which they kept an undue quantity in their hut, was found one morning to be frozen, and the head man proceeded to thaw it over an open fire in the but by a process which can only be described as grilling it. The man was an experienced miner and had worked with dynamite for some years at Lefroy. He and another were killed outright by the explosion, and a third man died the next day.

Two men were scorched and bruised by an explosion of dynamite in the Western mine, at Mount Zeehan. They were blasting the face of a drive, and had charged two breast holes and one bottom hole; they fired the bottom hole first, and immediately after its explosion returned to fire the other two, when one of these exploded as they neared the face, its fuse having been ignited by the first explosion. The men had nobody to blame but themselves, as they should not have charged the upper holes till after they had blown out the bottom one.

Two men were hurt in the Mount Victoria mine through attempting to bore deeper a portion of a hole in which a charge of dynamite had been previously exploded. There was a small piece of an unexploded cartridge in the hole, and one of the men pulled it out and then inserted a gad into the hole and struck it with a hammer; some nitro-glycerine must have oozed out from the old charge, for an explosion followed the blow. The practice of boring old holes deeper is expressly forbidden by law in Victoria, New Zealand, and elsewhere, and should be here also. The mining manager affirmed that he had often cautioned the men against boring in old holes, hence they had only themselves to blame.

The remaining accident was from an explosion of gunpowder in the Dulverton colliery. A man was charging a hole that was horizontal, or slightly inclined upwards, and was driving up the powder with a wad of paper taken from his pocket. After the explosion which ensued he remembered having wrapped some matches in this piece of paper. When struck by the tamping bar, which was of wood shod with copper, the matches must have ignited and fired the powder. The man's injuries were, luckily, only slight—the charge blowing out over his shoulder without throwing its burden.

It will be seen that all the accidents from explosives were due to carelessness or ignorance of the injured men.

(2.) *Falls of Earth.*—There were five accidents from this cause, resulting in the deaths of one European and one Chinese, serious injury to one European, and slight injuries to one European and one Chinese. The European miner who was killed was a tributer, and his own master in working his claim. While working at the foot of a high, steep face of gravel, a fall took place and killed him. His mate deposed at the inquest to having tried to persuade him not to trust himself under the face. The European who was seriously injured was working in the Dulverton colliery, and in his desire to get coal neglected to put in sufficient props under the roof, part of which fell upon him.

All the other accidents from falls of earth appear to have been pure misadventures, and not preventible by any foresight.

(3.) *Falls down Shafts, Winzes, or Passes.*—There were five accidents from this cause, one being fatal, the others of a slight nature. The fatal accident happened at Lefroy, in the new shaft being sunk by the New Pinafore Company; one of the workmen was being drawn to surface by means of windlass and rope, when by some means he fell off and sustained injuries which proved fatal in a few hours. Only a fortnight later an exactly similar accident occurred in the shaft of the Dilston colliery. In this case the man, ascending with his foot in the bucket, is supposed to have been struck by the other bucket descending; he was fortunate enough not to be severely injured. In neither of these cases were safety-straps used for staying the men to the rope as required by Section 11, Sub-section (16) of the Regulation of Mines Act, 1881; the mining managers of the two mines were therefore prosecuted for neglect to furnish such appliances. The Justices, taking into consideration the drawbacks to the use of cords or straps for staying men to the rope, and the sworn statements of numerous miners that they would not use them if provided, and that it was not expressly stated in the Act that special straps or cords were to be provided for staying men to the rope, and hence that it might be deemed sufficient if there were ropes about the mine which could be used by them if they should so desire, dismissed the case against the manager of the New Pinafore mine, upon which that against the manager of the Dilston colliery was withdrawn.

Of the other accidents from falls down shafts or winzes, one was due to a man missing his footing on a ladder-way, one to carelessly jumping down on to a platform near to the top of a winze and falling off it down the latter, and one to falling down a pass. None of these should have happened if ordinary care had been exercised by the injured men.

(4.) *Falls of material down Shafts.*—Two accidents from this cause resulted in slight injuries to three men. In every instance the men themselves were to blame for filling the bucket used in sinking too full, or for not steadying it sufficiently before it left the bottom of the shaft so as to prevent it swinging about as it was hauled up.

(5.) *Machinery in motion.*—Three men were injured, two rather seriously, by being caught in machinery. In these two cases the men were themselves in charge of the machinery, and were cleaning it while in motion. The other accident was a trivial one, but due to a mistake of an engine-driver, not of the person hurt.

(6.) *Other causes.*—By a fall of rotten timber while taking down some old trestle-work one man was slightly hurt. Another was injured by a splinter of a gad flying into his eye and injuring it so as to compel him to go to Melbourne for treatment. A third man received a serious scalp wound and blow on the head while running away from the face of a drive where an inrush of sand and water was taking place, by striking his head against a spreader which had been put in under the cap of one of the sets.

It is highly satisfactory to note that in very few of the above cases could any blame be fairly ascribed to the management of the mines. On the other hand it is not all satisfactory to see that almost every one of the accidents might have been prevented by the exercise of reasonable precautions by the workmen themselves.

Plans and Sections of Underground Workings.—The rapidly increasing number of mines with extensive underground workings has necessitated a large increase in the number of plans sent into this office, particularly as it is necessary, in order to ensure compliance with the Act as it now stands, that all mines likely to be large in future should be annually surveyed, mine-owners being only required by law to send plans of the workings made during the twelve months preceding the notice to furnish them. Hence, if a mine is allowed to go without being surveyed for some years there is no obligation upon the owners to furnish complete plans, and the obvious intention of the Act might be frustrated. The annual surveys entail a great deal of expense both to owners and the Government. It would be expedient in my opinion for the existing law to be amended so as to allow of the plans being furnished at longer intervals than one year, and to make it necessary for them always to show the complete workings of the mines, and not merely portions of them.

There has been such a demand for surveyors for the West Coast mineral lease surveys that it has been very difficult this year to get the plans of the mines sent in during January, as required by law, and in numerous cases extensions of time have had to be allowed for their production. Altogether, plans and sections of 27 mines have this year been received. They are all prepared by authorised surveyors, and in most instances have been well and faithfully made. Some, however, have had to be referred back to the surveyors for correction before being accepted.

Mines visited by Inspector.—Owing to press of other business, it has not been possible for me to make a regular round of inspection through all the mines of the Colony, and several districts could not be visited at all. The mines in the following districts have, however, been examined in the course of the year:—Beaconsfield, Brothers' Home, Moorina, Gladstone, Mount Zeehan, and Mount Dundas, and visits have been made to the New Pinafore, Dilston, and Dulverton mines on special occasions of accidents. The state of the mines as regards safety of the workmen and observance of the Regulation of Mines Act is generally satisfactory. Only one complaint as to insecurity of workings has been received from men working in the mines, the case being that of a mine at Mount Zeehan, where a shaft was being sunk without sufficient timbering. Instructions were at once given to properly secure the shaft, and were complied with immediately.

I have, &c.

A. MONTGOMERY, *Inspector of Mines.*

The Secretary of Mines, Hobart.

ANNUAL REPORT OF THE GEOLOGICAL SURVEYOR.

Geological Surveyor's Office,
Launceston, 20th July, 1891.

SIR,

I HAVE the honor to submit my Annual Report for the year ending 30th June, 1891.

During this period I have made examinations of the country in the vicinity of Spring Bay and Buckland with regard to the probability of finding coal there, of the north-western portion of Maria Island and its beds of hydraulic limestone, of the Mount Zeehan and Mount Dundas silver-lead fields, of the Beaconsfield District, in completion of the survey begun last year, and of the Gladstone District. I have had the honour to send you reports on all these. An Addendum to the Report on the Spring Bay coal field, giving further information as to the coal at the Back River or Prosser's Plains, has also been forwarded, and I append hereto a note of some facts that have reached me since, which affect certain particulars of the Report materially. Besides these reports, papers have been prepared for the Year Book of Australia and for the Tasmanian Official Record on the mineral resources of Tasmania, and for the Agent-General on the silver deposits of Tasmania.

Two new metallurgical processes which have come into use in neighbouring Colonies appear to be likely to be of great value—viz., the Molesworth Roasting Process and the Macarthur-Forrest Cyanide Process; and short descriptions of their principal features, as far as I have been able to ascertain them, are appended hereto.

Though the diamond drills are under the supervision of Mr. Commissioner Glover, the cores obtained have always been sent by him for my inspection; consequently I have prepared and sent herewith sections of the strata passed through in the various bores put down during the year. That of the East Tasmania bore is attached to my Beaconsfield Report already forwarded to you.

I have, &c.

A. MONTGOMERY, *M.A.*,
Geological Surveyor.

The Secretary of Mines, Hobart.

ADDENDUM NO. 2 TO REPORT ON COAL FOUND AT SPRING BAY.

Mr. R. Robinson, of Triabunna, who has taken very great interest in the prospecting for coal throughout the Spring Bay District, has, since my report was issued, written to me that I have been misinformed as to some of the old workings. This may very well be, as no written records appear to have been kept by my informants, who therefore spoke from memory only. There seems little possibility now of ascertaining which versions are most nearly correct, so I give Mr. Robinson's statement, as it differs considerably from those previously made by me to others.

Shaft C, known as Gurney's Shaft.—My informant as to the depth of this being 97 feet, and a drive having been put in for a distance of 50 feet, was to the best of my recollection Mr. Bresnahan, who worked himself in the mine. Mr. Robinson says:—"The facts are, that when the seam of coal (5 feet) was gone through in the shaft at a depth, as far as I can recollect, of 60 feet, a gullet was cut round the seam on the side of the shaft, and a block or section of seam was taken out, put into a box 5 feet long 18 inches square, and sent to Melbourne to show the seam to its full depth. . . . No drive was made in Gurney's shaft further than cutting round the seam to get a block out."

Shaft and Bore J.—With regard to this Mr. Robinson is a much better authority than anyone else, and speaks from a written record preserved by him. He gives the following section:—

	ft.	in.
Shaft.—Yellow clay	6	0
Yellow sandstone	10	0
White sandstone, soft and friable	12	0
Solid hard sandstone, dark grey colour, impregnated with fern fossils; alternate flat beds or laminations with fern fossils; largest depth without laminations 10 feet, beds horizontal	88	0
Soapstone, dark grey colour	8	0
Seam of coal, hard anthracite, and almost as near stone as possible	0	8
Soft soapstone, laminated	7	0
White very hard sandstone	14	0
Total depth of shaft	145	8
Bore.—Very hard basaltic sandstone (miners would call it bastard sandstone)	7	0
Dark sandstone, hard, free from fossils	30	0
Black clod	0	6
Dark soapstone	5	0
Black clod	0	6
Coal of a very hard character and inferior quality	1	4
Total depth of bore	44	4

Then very hard strata of a coarse character, quartzite, was reached, when water came freely and bore was abandoned. No 5 feet seam of coal was seen.

The borings with the diamond drill, now being carried out by Signor Bernacchi, will probably soon settle the question of the number of seams of coal that exist under Triabunna.

A. MONTGOMERY, *M.A.*, *Geological Surveyor.*

NOTES ON THE MOLESWORTH CALCINING PROCESS.

Mr. C. Ballard, Secretary of the Molesworth Ore-reduction Company, Limited, of Adelaide, has been good enough to send me copies of the specifications of the Molesworth Process Patents, and copies of newspapers describing the trials.

Mr. F. H. Molesworth is the inventor of the process, which is designed to greatly facilitate the roasting of metallic sulphides and arsenides. The calciner is a variety of the rotary type, and consists of a cast-iron cylinder wider at the end at which the ore is fed in than at the outlet end. It is rotated by suitable gearing outside, and runs on friction wheels so as to turn easily. Rows of small shelves are provided inside for raising the ore as the calciner revolves and showering it through the oxidising current of air. The cylinder is fixed so that the ore keeps constantly travelling downwards towards the outlet end, and, by altering the inclination and the number of revolutions, the time required to pass a charge through may be varied. So far, the description would answer for numerous revolving continuously-discharging roasting furnaces in common use. In these, however, the flames from the fireplace pass directly through the calciner, and the draught is always so great as to winnow out all the finest dust from the charge of ground ore, thus necessitating the use of long dust chambers. The new calciner is heated from the outside, and the draught through it need only be sufficient to supply the air necessary for combustion of the metallic sulphides. The roasting, it is said, need not be done at such a high heat as to injure the iron cylinder. A low temperature of roasting, which is, for many purposes, a great advantage, is therefore another point claimed in favour of the process. To economise fuel, and yet heat the cylinder as evenly as possible, the fireplace of the furnace used is built under the discharge end of the apparatus, where the greatest heat is required. The flames and hot air pass round this, and then are made to circulate round the remaining part of the cylinder by means of a spirally-arranged flue. The ore is ground to whatever fineness is deemed desirable, and fed continuously from a hopper into the wider end of the calciner. Up to this point there is still nothing very new about the arrangement, and if the only improvement consisted in heating the calciner from outside instead of sending the furnace gases through it, it would probably be found to be more expensive and less efficient than the common types. The novelty, which is the real heart of the invention, is the use of nitrogen peroxide gas to assist the oxygen of the air in burning off the sulphur and arsenic. This gas is a powerful oxidiser, giving off half of its contained oxygen very readily, and so becoming reduced to nitric oxide gas. This latter gas, in contact with air, at once combines with more oxygen from it, and is reconverted into nitric peroxide. This gas acts, therefore, as a carrier of oxygen from the air to the substances to be burned. Were it possible in practice to avoid loss of gas, it would be possible theoretically for a very small amount of nitrogen peroxide to work in the roaster for ever. The action of the gas as a carrier is well known and taken advantage of in the manufacture of sulphuric acid. The narrowing of the cylinder at the outlet end is said in the patent specification to be for the purpose of applying the gas there in its most concentrated form, just as it is delivered from the retorts. These are placed on top of the flues of the heating furnace, and contain crude nitrate of soda and sulphuric acid. The temperature is sufficiently high to break up the nitric acid formed by the reaction of these substances into water, nitric peroxide, and free oxygen. These are drawn from the retort into the calciner along with the necessary supply of air by means of a suction fan in the flue leading the products of combustion away from the cylinder. In order to recover the nitrogen oxides, and also to prevent the escape of the acid gases from the process generally, the products of combustion are drawn through water. As crude nitrate of soda contains a good deal of chloride of sodium, a quantity of hydrochloric acid comes into the apparatus, as well as oxides of nitrogen, and, as the sulphur of the ore burns to sulphur dioxide gas, and the arsenic to arsenious oxide, the water through which the gases are drawn becomes highly charged with nitric, sulphuric, hydrochloric, and arsenic acids. According to the patent claims, this acid mixture is to be used to dissolve gold from the roasted ore when auriferous pyrites have been treated.

As far as the roasting is concerned, the process seems to make excellent use of a well-known chemical principle, and accordingly the results claimed to have been obtained are quite credible, but I cannot say the same of the alleged treatment of the gases after they leave the furnace. In the first place it is notoriously a difficult matter to arrest furnace gases by drawing them through water except by the use of costly and cumbrous coke or flint washing towers. Secondly, the acid obtained would be so impure as to be unfit for use in dissolving out gold. Moreover, it would be mostly sulphuric acid, formed by the oxidation by the nitrous gases of the sulphur dioxide from the combustion of the ore. Even if it were nitro-hydrochloric acid, however, it could not be used for the purpose of dissolving out the gold from roasted pyrites, for *aqua regia* is not like chlorine, able to exercise a selective action on the gold without attacking the oxide of iron, but would dissolve the latter and expend itself in doing so. The waste acid might possibly by boiling be made to give off chlorine, which could be used for chlorination, but I am afraid that the claims made for this part of the process have not been practically worked out. Even on theoretical grounds they are open to many objections.

The claims in the patents as to the use of the waste products of combustion do not affect the main issue—the success of the roasting. It is clear, however, that the construction of the furnace renders it possible to make sulphuric acid from the waste gases with a success shared by none of the calciners where the products of combustion of the fuel are mixed up with those of the ore, and a saving of cost might be effected by doing so. The rapidity of the roasting, implying a very copious evolution of fumes of sulphur dioxide, would be very favourable for the supply of this gas to sulphuric acid chambers in a sufficiently undiluted condition.

The process has been introduced at the New Alma and Victoria gold mine, Wankaringa, South Australia, and is reported to be working very well. The newspaper reports are very favourable as to the great rapidity, cheapness, and thoroughness of the roasting, and private information given to me confirms them. Very little nitrate of soda is required, and very little fuel for the heating furnace, the combustion of the sulphides itself supplying the greater part of the heat required. Though still hardly past the experimental stage, the results of Molesworth's treatment appear to be so good that the process deserves the attention of all concerned in the roasting of sulphide ores. Probably experience will result in numerous changes in the details of the plant, and very likely in its entire remodelling: such changes are a part of the evolution of every new process. Should the use of the oxides of nitrogen come up to the claims made for them in assisting oxidation, the new treatment will mark an important advance in one of the most important, universal, and expensive processes of metallurgy.

A. MONTGOMERY, *Geological Surveyor.*

THE MACARTHUR-FORREST CYANIDE PROCESS FOR THE LIXIVIATION OF GOLD AND SILVER ORES.

This process has been introduced by the Cassel Company at Karangahake, Auckland, New Zealand, and as the results obtained have been very good on an ore that has hitherto defied successful treatment by amalgamation, it appears likely to be a commercial success, and worth the attention of mining men. The ore treated was from the Crown mine at Karangahake, which consists of quartz charged with extremely fine metallic gold and sulphide and selenide of silver, with, occasionally, chloride of silver as well. From the difference between the amount of gold visible on the most careful grinding and washing or that can be extracted by amalgamation, and that obtained by assay, there is reason to believe that much of the gold is not in a free state, but exists in combination with the sulphur and selenium present. The ordinary battery treatment is quite a failure with this ore, extracting only from about one-fifth to one-third ot the gold value. Amalgamation in pans succeeds much better, but is not altogether satisfactory either. The ore is much too silicious for smelting, and the chlorination treatment requires it to be roasted before it can deal with it, and then is not very successful after all. It is, therefore, a very difficult ore to deal with, and the cyanide process in successfully treating it has scored a victory over many competitors.

The result of a bulk test of a parcel of 263 tons 7 cwts. treated is given in the *Auckland Weekly News* of 14th March, 1891, as follows:—

263 tons 7 cwts. contained, by assay, gold, 425 ounces; silver, 940 ounces.
Recovered and sold to the Bank, gold, 384 ounces; silver, 664 ounces.
Percentage of recovery, gold, 90½ per cent.; silver, 70½ per cent.

The cost of treatment is stated to have been 6*s*. 6*d*. per ton for drying and grinding the ore, and 13*s*. 6*d*. a ton for the lixiviation treatment. It will be seen that the extraction was very successful, the gold left in the tailings being only at the rate of 3 dwt. 3 grs. to the ton, and silver a little over an ounce to the ton.

The process depends on the fact that a weak solution of cyanide of potassium will dissolve gold, silver, and most compounds of silver very freely. A weak solution acts better than a strong one, and hence solutions containing only from ¼ to 1 per cent of cyanide are employed. No roasting is required, it being claimed for the process that it will extract both gold and silver from metallic sulphides without roasting. I am not aware, however, if this has been proved on a working scale. The ore is ground dry in Lamberton Mills, and put into wooden leaching vats furnished with false bottoms arranged for filtering, as in all other leaching processes. The quantity of solution necessary is about half the weight of the charge of ore, so that from 3 to 8 lbs. of cyanide are used for every ton. It is made to take about 36 hours to pass through the ore-bed on the filters, and then runs into a series of wooden precipitating boxes filled with coarse g lated zinc. The gold and silver are precipitated on the zinc. The solution, after passing through boxes, is assayed to ascertain its loss of strength, and made up to the original condition by the additi a little more cyanide, and then may be used again. The gold and silver are recovered from the si putting the contents of the precipitating boxes on a sieve and shaking this well in a vat of water. The precipitate is thus washed off and the zinc is returned to the boxes again. The muddy sediment of and silver is allowed to settle thoroughly, collected, washed with diluted sulphuric acid to remove an left in it, washed well with hot water, filtered through calico filters, dried, and melted into fine bullion.

Part of the above description is taken from the annual volume for 1890 of "Reports on the M Industry in New Zealand," wherein Mr. H. A. Gordon gives a fuller description, illustrated by draw The following table of results obtained in the preliminary trials of the process at Karangahake is ab from his report. Each of the tests was made on one ton of ore; consequently, they are working test mere laboratory ones.

Assay Value of Ore per Ton.		*Extracted per Ton.*		*Percentage Extracted.*		*Percentage of Potassium Cyanide used on Ore treated.*
Gold.	Silver.	Gold.	Silver.	Gold.	Silver.	
oz. dwt. grs.	oz. dwt. grs.	oz. dwt. grs.	oz. dwt. grs.	Per cent.	Per cent.	
0 19 4	10 1 17	0 16 14	7 2 0	86·5	70·4	0·50
0 19 14	10 1 17	0 17 23	7 9 1	91·7	73·8	0·50
1 12 16	14 14 0	1 11 1	11 7 0	95·0	77·2	0·50
1 12 16	17 12 0	1 7 9	11 9 3	83·9	62·2	0·40
1 12 16	16 6 16	1 6 4	9 6 1	80·1	56·9	0·25
1 17 13	1 17 13	1 14 7	1 4 12	91·2	65·1	0·50
1 17 13	1 17 13	1 12 16	1 2 21	87·1	60·6	0·50
2 2 4	2 4 2	1 19 18	1 12 16	94·2	74·3	0·25
2 2 11	2 4 2	2 0 20	1 1 6	96·0	47·7	0·25
0 11 10	3 11 20	0 9 10	1 19 4	82·4	54·4	0·25
1 12 16	5 14 8	1 7 19	4 3 8	85·0	72·8	0·25
1 19 4	6 4 3	1 15 22	4 18 0	91·8	79·0	0·40

A. MONTGOMERY, *Geological Surv*

REPORT OF THE MOUNT CAMERON WATER-RACE BOARD TO 30TH JUNE, 1

11*th August*, 1

Sir,

This Board has the honor to report as follows.

The Board was constituted by Act of Parliament, 51 Vict. No. 28, on the 20th December, 188 consists of the Secretary of Mines, the Commissioner of Mines for the District, the Inspector of and two members annually appointed by the Governor in Council. It commenced its duties on t February, 1888, and assumed control of twelve miles of main race and nine miles of branches, which, the authority of the Act quoted, had been purchased by the Government at a cost of £4750.

On the 21st of August last the Board received into its charge the whole work, consisting of 34 of main race and 9 miles of branches (including the original portion above referred to), which had constructed and repaired by the Government at a total cost of £31,460 7*s.* 3*d.*, including purchase o old portion of the race.

The receipts during this period, necessarily curtailed by stoppages for repairs and the limited s of water obtainable, and of ground commanded by the old race, amounted to £687 13*s.* 11*d.*, whil cost of maintenance and management amounted to £631 14*s.* 5*d.*

During this period there have been 2330 heads of water sold. Receipts have been £1751 5*s.* 1*d* the cost of maintenance and management has been £1087 9*s.*

The total sum paid to Sinking Fund to date has been £719 5*s.* 7*d.*, being ¾ per cent. upon the cost; but, at the present rate of receipt and expenditure, the net proceeds for the year 1891 will be 2 cent. upon the cost of purchase and construction.

The number of claims supplied since the race has been in full work has averaged, weekly, 10. which employ a considerable number of miners and yield a fair quantity of tin ore, could not have worked but for the construction of this race. Other claims are in course of being opened.

The race has a carrying capacity of 50 Tasmanian heads, discharging 450,000 gallons per hour. supply of water at the intake is more than sufficient to meet the present demand.

This is regulated according to the price of tin; but, with tin ranging from £80 to £100 per ton, the charge per head per week of six days of eight hours each has been 15*s*. per head for day water and 13*s*. 4*d*. per head for night water; prospecting water is granted at the rate of 10*s*. per head.

The Board employs a manager and four watermen and channel-keepers, whose duties consist in distributing the water and keeping the channel in order throughout its whole length.

In view of the fact that the quantity of water available is larger than the demand, and that a considerable area of ground is situate upon the western or Gladstone side of the Ringarooma River, which could be profitably worked by an extension of the race for a distance of about 4½ miles, at a cost of not exceeding £4000, a survey has been made, and a proposal will be submitted to Parliament to sanction the work, which, the Board is led to believe, will be of great benefit to the profitable working of the Race and to the community.

We have the honor to be,
Sir,
Your obedient Servants,
F. BELSTEAD, *Chairman.*
JOHN SIMPSON,
A. MONTGOMERY,
S. HAWKES,
C. O'REILLY,
Members of the Board.

The Honorable the Minister of Lands and Works.

REPORT ON THE PROPOSAL TO BORE FOR COAL IN THE TOWNSHIP OF TRIABUNNA, SPRING BAY, AND ITS NEIGHBOURHOOD.

Geological Surveyor's Office, Launceston, 2nd August, 1890.

SIR,

I HAVE the honor to report that, in accordance with your instructions of the 8th July, I went to Spring Bay on the 15th ult., and put myself in communication with the Warden of the Municipality, Mr. Lester. I found that it was desired that I should report on the advisability of having a series of borings made by means of the diamond drill, to ascertain if payable seams of coal exist in the district, and on the the sites for such borings if undertaken. An examination of three different localities in this connection was requested,—namely, the township of Triabunna and its immediate vicinity, the Ravensdale Estate near Little Swanport, and Prosser's Plains on the Back River, some four miles west of Orford.

Triabunna and its vicinity.—I attach a map of the township of Triabunna and the country immediately surrounding it for the purpose of explaining this report. The township is laid out at the head of Spring Bay on a large alluvial flat, bounded towards the north and north-west by high hills of greenstone, and rising towards the south and south-east into low hills of sandstone. At Orford the greenstone ranges sweep round and come out on the coast line at the mouth of the Prosser's River, but between Orford and Spring Bay the country may be said to be all sandstone, with the exception of a mass of greenstone at Meredith Point. On the eastern side of Spring Bay the sandstone country predominates, reaching through to Oakhampton. The high spur running southward to terminate in Cape Bourgainville is, however, greenstone, and a great mass of this rock also reaches from Point Horne Look-out nearly to the Oakhampton quarries. Most likely there are many other intrusions of greenstone in the low range separating Spring Bay from Oakhampton Bay. Three dykes of this rock penetrate the sandstones at Dusky Bight, the Oysterman's Station, and to the north and south of these the sandstones are hardened, jointed, and baked-looking, as if they had been subjected to the action of great heat. The argillaceous nature of the sandstones on the beach allows them to show the effects of heat more than the white quartzose freestones overlying them. Whether the main masses of greenstone have been intruded through the sandstones or are of older date I have seen no evidence in the district to pronounce with any certainty, but in either case the result is the same as far as coal seams are concerned, the greenstone must cut them off. If the greenstones are of later formation than the coal measures, it is possible that they may form cappings over the latter in places, but I fear that much hope cannot be founded on this possibility in the district now in question, appearances being much more in favour of the belief that there have been no large overflows from the dykes. We may, therefore, regard the greenstones as forming the boundaries of the coal formation. It is a very difficult matter to make out the amount and direction of dip of the strata in this locality, owing to the sandstones which show in all the available sections being very much "false-bedded." As the result of a large number of observations, I came to the conclusion that there is on the whole a very gentle northerly dip of from one to two degrees, but that there are gentle undulations which alter the direction and amount of the dip very considerably. Faults breaking the strata are also probably present. Selwyn, in his report on this district, mentions a fault showing at the head of the estuary. I was not able to find the spot, probably owing to the creek being somewhat high, but the differences in level of the seams of coal struck on the east and west sides of the estuary of themselves point to the existence of such a fault. On the beach at the east end of Vicary street there is a bed of shaly clay striking N. 47° W., and dipping to the N. E. at the high angle of 52°, which indicates the proximity of another fault, the sandstones immediately to the southward being nearly horizontal.

There are two very distinct sorts of sandstone found in the area under consideration, one very quartzose, sharp to the touch, white or yellow freestone, the other composed chiefly of fragments of a felspathic rock now altered to clay, and containing sometimes very little, sometimes a good deal, of quartz sand. This is generally of a greenish grey, sometimes yellowish colour, and frequently contains fragments of carbonaceous matter. Some of the beds contain mica, occasionally in considerable quantity. The felspathic sandstone lies immediately over the principal coal seam in all the shafts sunk to it on both sides of the estuary. It is seen on the beach all around the head of the estuary. From Patten Point southward along the eastern shore of Spring Bay to opposite Observatory Point a bed of felspathic sandstone is found similar in most respects to that just mentioned. It is overlaid by white freestone, which, from being 15 to 20 feet above high water mark opposite Observatory Point, dips gently down until north of Patten Point it altogether conceals the felspathic rock beneath. At Patten Point there is an outcrop of micaceous, black carbonaceous shale, and along the beach to the northward I found numerous fragments of hard brick red shales containing impressions of leaves of one of the typical fossil ferns of our upper coal measures. As I could not find any of this shale *in situ* above high-water mark, it seems likely that it lies lower down, perhaps under the felspathic sandstone. From its appearance, however, I should judge that the intrusive greenstone cannot be far from it, as it appears to have been hardened and altered by heat. It seems probable that the two beds of felspathic sandstone mentioned are separated by a thick bed of white freestone, and borings through the first felspathic bed, after passing through the known seam of coal underlying it, should be carried down through the freestone to try for a lower bed of coal in the second felspathic stratum.

A good deal of work has been done already to test the coal in this neighbourhood. On the map I have marked the positions of the various workings as nearly as I could ascertain them. It is much to be regretted, however, that reliable information as to what has been done in the past is now very difficult or impossible to obtain. Even when Mr. Selwyn reported on the field in 1855, he was unable to get exact information as to much that had been done. As his report is now almost unobtainable, I attach a copy of his plan and sections, and of the part of his report relating to Spring Bay. On my plan the letters A, B, C, and D refer to the shafts and bores denoted by the same letters on Mr. Selwyn's plan, except that C is now what is known as Gurney's Shaft, the shaft having been sunk on the previous bore. E on the plan is the site of another bore, pointed out to me by Mr. Bresnahan, but about which I could get no information whatever. F, G, and H are shafts sunk since Mr. Selwyn's report, about 1873, on the township, and J is a shaft sunk in 1875. K is the place where I think it would be advisable to bore with the diamond drill. In the shaft C, I was informed a seam of coal 4 inches thick was passed through at a depth of about 45 to 50 feet, and at 97 feet a seam 5½ feet thick was encountered. A drive was put in on this for 50 feet, but the coal proved useless. It has been suggested, with a great deal of probability, that the intrusion of the greenstone ridge to the north-east of the shaft may have been the cause of the impregnation of the coal with the large amount of mineral matter it contains. I was not able to get any of the coal to test this supposition in any way. This seam appears to be from 50 to 52 feet below high-water mark at points B and C. The stones round C show that the stratum of felspathic sandstone met with in shafts H and J here also immediately overlaid the coal, thus establishing the identity of the seams, and showing that there must be a downthrow on the eastern side of the fault. Shaft D, as Selwyn observes, is south of the line of outcrop of the coal, which must here dip to the northward more than two degrees, otherwise it would have been cut in the shaft. Shallow borings in the flat between C and D would probably soon strike the outcrop of the seam. I have not been able to find if any coal was got in the shaft F, but from both G and F coal was raised, and I was told that a shipment of 50 or 60 tons had been sent to Melbourne, but my informant could give me no information about its quality or the price it brought. From G a drive was made towards the Roman Catholic Chapel, or about N. 55° W., but whether it was driven level, on the dip, or to the rise, I could not find out. If level, its direction gives us the dip of the seam as about N. 35° E., which agrees fairly well with some other observations. It is to be presumed, from the fact of the abandonment of the mines, that the coal was not of good quality. None of it is now obtainable. At J a shaft was sunk for 155 feet, passing through felspathic sandstone full of carbonaceous matter, and with occasional thin beds of shale and of carbonaceous matter full of iron pyrites. From the bottom of the shaft a bore was put down for a further distance of 80 feet, which cut a seam of coal 5 feet thick at 205 feet, and then passed through several feet of fire-clay. Nothing further was done. It is clear, therefore, that the greater part of the western portion of the township of Triabunna is on coal, though probably much of it is of poor quality. Some 20 or 30 chains below the junction of Brady's and M'Laine's Creeks, the white, gritty sandstone crops out in the bank of the latter, lying nearly horizontal, and similar sandstone is seen in the flat to the west and south of it also. The coal-bearing area at present known may be said to lie between a line drawn N.W. from shaft F and the greenstone hills to the north of the township.

As the residents are anxious to set the question of the existence of workable coal at rest, I would recommend that they bore at K with the diamond drill. This is about the centre of the known coal area. The 5-foot seam ought to be struck at about 120 to 130 feet, and the bore should then be carried down to 700 or 800 feet to try for lower seams which may or may not exist. It is true that the shaft D shows no coal for a depth of 200 feet below the known 5-foot seam, but the beds of carbonaceous shale and felspathic sandstone found on the eastern side of Spring Bay do not appear to have been reached in it. These appear to underlie the white sandstones met with in the shaft, and may dip to the north-east more rapidly than their apparent north-westerly dip along the shore would indicate. As mentioned above, a bed of fossiliferous shale seems to exist somewhere in connection with the felspathic sandstone near Patten Point, which, with the carbonaceous shales, would indicate that it is by no means below the horizon at which coal might be expected. The large amount of false bedding of the sandstones may be taken to indicate that they were laid down in shallow water, consequently slight changes in the level of the shore might have led to the alternate formation of beds of sandstone and coal. The littoral character of the sandstones in this part of the country is further shown by the occurrence in Crabtree's Quarry, near Orford, of a bed of coarse gravel lying in a depression hollowed out of the previously existing sands. In this quarry it was reported that a bed of black shale was struck below the sandstones; but, if so, it is now quite covered over again. It is only by boring that the existence of lower beds of coal can be demonstrated or disproved; and, looking to the magnitude of the gain to the colony and to the district, should good coal be found near to such a splendid harbour as Spring Bay, I certainly think a bore should be put down. That there is a great risk of failure to find any coal of value is indubitable; but, on the other hand, the reward of success is a great one. If the bore at K were carried down, say, to 800 feet, it would almost certainly yield us sufficient information to judge of the advisability of boring in other places in the district. To test the ground thoroughly, at least three bores are required: one in the middle of the large flat to the west of the township, and another inland to the east from Patten Point about 20 chains, in addition to the one at K. The boring should not prove very expensive. The strata are probably similar to those passed through by the diamond drill at Seymour, where the cost was 7*s.* 8½*d.* a foot. This might be fairly taken as a probable estimate of the cost of boring at Triabunna also.

Ravensdale Estate.—No coal of any sort has yet been found in this locality, but there is a very considerable extent of the coal measure sandstones, and there is therefore a possibility of finding coal by boring. On the road from Triabunna to Little Swanport greenstone is the prevailing rock passed over, though there are occasional patches of sandstones. The relation of these to the greenstone seems to me to favour the theory that the latter rock is of more recent formation than the sandstones, and intruded through them. Occasional dykes of greenstone may be seen clearly penetrating the sandstones, and I could see no reason to suppose that these dykes were of later origin than the main greenstone masses.

Between Triabunna and Grindstone Bay, and from Grindstone Bay north to Little Swanport the country is said to be all sandstone, so that if coal were found in it there would be a large field. Prospecting by borings is therefore well worth trying.

The Ravensdale estate contains a large extent of sandstone country. A large mass of greenstone comes into the southward from Mr. Salier's residence, and this rock also cuts off the sandstone to the south-west in Mr. Chaffey's property. The sandstones seen in the Ravensdale Rivulet are yellowish brown quartzose freestones, more highly inclined than those around Triabunna. No fossils were seen in them. In the creek some 30 chains above the shepherd's hut, beds of shale dipping east 4° to 5° are found. These underlie the sandstones found lower down the creek. I did not find any fossils in these either, and their position in the coal measures is therefore doubtful. Interstratified with the shales a thin bed of greenish felspathic sandstone similar to that overlying the Triabunna coal was noticed. Lower down the creek the sandstones dip more steeply, angles of 21° and 25° being observed, and at the crossing of the creek to the shepherd's hut and lower down it they again appear to be flatter, the angle of dip being from 7° to 8° easterly. As the section of the creek exposes a great thickness of sandstone beds without coal, I think that the best place to bore would be south of Shepherd's hut, where the drill would soon reach the unseen strata lying beneath the shales above-mentioned. A bore about 5 chains up the creek from the hut would be well situated.

Prosser's Plains, Back River.—This appears to be the most promising place of the three visited for finding payable coal, as the existence of a useful seam is known, and what has to be ascertained by boring is its extent and depth below the surface. The coal crops out in the Back River in Section 1682. The river being in flood at the time of my visit, the outcrop was not visible. Mr. Selwyn reported in 1855 on this coal as follows:—"At Prosser's Plains, in the Back River, a branch of Prosser's River, and about five miles from the residence of T. Cruttenden, Esq., two seams of coal occur, together about four feet thick, dipping (S. 15° W.) to (W. 20° S.) from 35° to 50°, and passing under a flat of about 2000 acres. These coals are bituminous, though not of first-rate quality. They ignite freely, and burn with a bright flame, but are of rather slaty structure, and contain a large percentage of earthy and incombustible matter. On three sides of the flat the carboniferous beds are cut off by high ridges of massive greenstone; but on the fourth side, towards the plain and in the direction of the dip, no eruptive rocks occur. In this direction the above seams of coal, and perhaps others, might be found at no great depth, over a considerable area. The distance, eight or ten miles, from the nearest shipping-place in Prosser's Bay, and the great expense attendant on the construction of the necessary road, appears the chief difficulty in the way of their being worked to advantage. The greater part of the ground is, I believe, the property of the Crown. The very high angle at which the seams are dipping where exposed in the Back River is probably only local; and they would most likely be found to flatten at a short distance on the dip, in conformity with the overlying sandstones to the south west."

I have very little to add to Mr. Selwyn's lucid description. The whole of the flat, from the outcrop of the coal down to the Prosser's River on the course of the Back River, is sandstone,—the greenstone rising abruptly on the east side of the latter stream. To the south west from the outcrop there is sandstone for a long distance, and this sort of country extends through to the back of Buckland. If coal lies under all of this sandstone, the field will be of great importance. Some years ago a shaft was sunk in the flat to the south of the coal outcrop about half-a-mile, but I could get no information as to its depth. It was abandoned before reaching the coal. The rock passed through was a somewhat felspathic sandstone, but containing more quartz sand than the felspathic sandstone over the coal at Triabunna. The same rock is seen in the side of the Back River, near the outcrop. Another shaft was sunk close to the outcrop many years ago, and coal was taken from it. I collected a few of the fragments strewed about the surface, and sent them for analysis to the Government Analyst. He reports thus:—

"The sample of coal from Buckland forwarded by the Government Geologist has been examined, and the following results obtained:—

	Per cent.
Fixed Carbon	73·6
Matter volatile at red heat	15·1
Sulphur	0·7
Mineral matter (ash)	8·0
Moisture lost at 212° F	2·6
	100·0

The coal does not coke. A workable seam of this quality would be of great value."

Local reports have always agreed in describing this coal to me as caking when fired. Possibly the weathered fragments analysed have lost this property. The analysis cannot be looked upon as fairly representing the bulk of the seam, as I did not pick up any of the fragments of black shale accompanying those of coal, though doubtless both came from the seam. It rather represents, probably, the purer bands of coal in the seam.

I have no hesitation in saying that boring should undoubtedly be done in this locality. The extent of the measures, and the size and quality of the seam, give every hope that payable coal will be found. For the first bore I should recommend a site about 10 or 15 chains W.S.W. from the outcrop. The unfinished shaft above mentioned would be a good site for a second bore.

The distance from the outcrop to deep water in Spring Bay is in a direct line about seven miles. I do not think that there would be any unusual engineering difficulty in getting a tramway to the harbour in about ten miles of distance. This would be no great matter if the coal was of good extent and quality.

Parishes of Hodgson and Page.—A glance at the county map shows the Parishes of Hodgson and Page to be still almost entirely Crown lands; I was informed that these lands were barren sandstone country, not fit for agricultural and pastoral purposes, and consequently not taken up. If the borings at the Back River and Triabunna should find good coal, there will be good reason to hope that it also exists under these barren lands. A geological examination of these should be made, and, if required, bores should be executed to test for coal.

In concluding this Report, I have to acknowledge many courtesies and much information from Mr. Lester, the Warden of Spring Bay, Mr. J. J. M'Clusky, Messrs. Salmon, Salier, Pitt, Mace, Stewart, and others, who did all they could to show me the District and to explain what had been done.

I have, &c.

A. MONTGOMERY, *M.A.*, *Geological Surveyor.*

The Secretary of Mines, Hobart.

COPY OF PORTION OF MR. A. R. C. SELWYN'S REPORT UPON SOME OF THE COAL SEAMS OF VAN DIEMEN'S LAND, 1855.

"*Spring Bay and the Township of Triabunna.*—The vertical section, Pl. II., Figs. 1, 2, 3, 4, are drawn from data furnished by Mr. Vicary.

The works are all abandoned for the present, and the shafts full of water. I was, therefore, unable to examine any of them.

As I had no map of the locality, the plan is merely a sketch of the surface, in which I have attempted to show the position of the different workings, and the general relations of the beds as seen on the surface. The shaft marked D was the first work executed, and was sunk with the intention of cutting the 3½ foot seam of coal, which is seen cropping below high-water mark on the west bank of the estuary, and which, but for the existence of the fault A.B., of which the parties do not seem to have been aware, would have been successful. Owing to this circumstance, however, they sank and bored 200 feet in beds immediately underneath the crop of the coal, and which are exposed to view on the surface to the south along the shores of the estuary,—thus wasting both time and money.

In the several bores and shafts A. B. C. D., a thickness of nearly 400 feet of coal measures has been proved, in which only one seam of coal of a workable thickness exists.

This seam could, however, I think, be worked over an area of at least 300 acres: this, taking the seam at 3 feet, and the cubic foot of coal at 56 lbs., would give something like 900,000 tons of coal. The seam is said to be 5 feet, but it has never been cut except with boring-rods at B. and C. on the plan.

The largest workable area would probably be on the west bank of the estuary, where no works have hitherto been executed, the land being a Government Township Reserve.

In the area above described no shaft would, I think, require to be carried more than 200 feet in order to obtain coal. I was unable to obtain specimens from which the quality of the coal could be judged; but Captain Vicary states that it is an excellent bituminous coal, ignites freely, and burns with a bright flame. Such being the case, and considering the proximity to the shipping-place, some additional outlay in this locality would, I think, be desirable, and would, if properly expended, in all probability result in the discovery of a workable coal-field."

ADDENDUM TO REPORT ON COAL FOUND IN THE NEIGHBOURHOOD OF SPRING BAY.

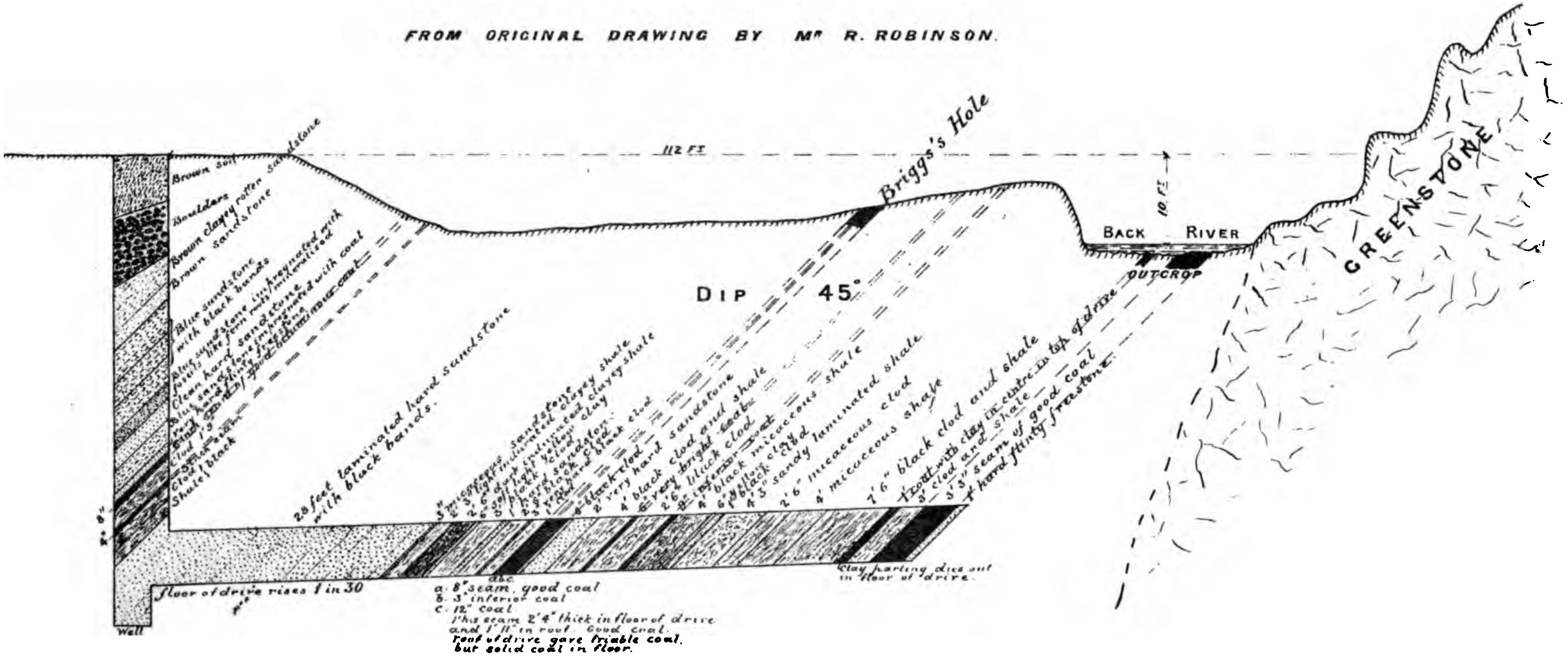
Geological Surveyor's Office, 29th September, 1890.

SIR,

IN my Report to you of August 2nd, 1890, on the coal fields in the Spring Bay Municipality, I was unable to give any definite information as to the work that had been done to prove the seams of coal known to crop out in the Back River at Prosser's Plains. Since writing it Mr. R. Robinson, of Triabunna, has shown me a record kept by him of the strata passed through in a shaft and drive which he executed there more than sixteen years ago. This record was in the form of a section, and is of such importance that I have made a copy of it, to a smaller scale, which is attached hereto. The description of the strata is Mr. Robinson's, with one or two unimportant verbal alterations. I have added to the section on the right hand side a dotted line to show the probable occurrence of the greenstone below the surface. The following note on the face of Mr. Robinson's section is of consequence:—"*Note.*—Basalt hill the cause of the

SECTION OF SHAFT AND DRIVE AT THE BACK RIVER
PROSSER'S PLAINS

FROM ORIGINAL DRAWING BY Mr R. ROBINSON.


112 FT
Briggs's Hole
10 FT
BACK RIVER
OUTCROP
GREENSTONE
DIP 45°
Brown soil
Boulders
Brown clayey rotten sandstone
Brown sandstone
Blue sandstone with black bands
Blue sandstone impregnated with fossils like fern mineralised
Clean hard sandstone
Blue sandstone impregnated with coal
Very hard flinty freestone
Band of good bituminous coal
Clod 1' 9"
Stick seam
Clod
Shale black
28 feet laminated hard sandstone with black bands.
3" micaceous sandstone
2' 3" light indurated clayey shale
2' 6" dark indurated clayey shale
2' 6" soft light yellow clay
5' black clod
1' hard sandstone
2' 3" black clod
1' 9" very hard black clod
8" black clod
2' very hard sandstone
4' black clod and shale
6" very bright coal
2' 6" black clod
8" inferior coal
4' black micaceous shale
6" yellow clay
1' black clod
4' 3" sandy laminated shale
2' 6" micaceous clod
4' micaceous shale
7' 6" black clod and shale
1' coal with clay in centre in top of drive
3' clod and shale
3' 3" seam of good coal
4' hard flinty freestone
2' 8"
Well
Floor of drive rises 1 in 30
abc
a. 8" seam, good coal
b. 3" inferior coal
c. 12" coal
This seam 2' 4" thick in floor of drive
and 1' 11" in roof. Good coal.
roof of drive gave friable coal,
but solid coal in floor.
Clay parting dies out
in floor of drive.

Shaft 50 ft deep. Drive 80 ft long. Scale 15 ft to an inch.

upheaval; height of hill, 200 feet; angle of slope, 45 degrees. All the seams of coal gone through have thickened at lower end of dip, and quality of coal improved considerably. If the seams of coal had been struck in the shaft instead of the drive they would have been a deal thicker and harder, as the great difference in the thickness of the seams at the lowest point of dip proves beyond doubt, and likewise the superior quality of coal, as it seems to lose its friableness at the lower end of dip. (Signed) R. Robinson, May 30th, 1874."

From the section it will be seen that seven seams of coal were passed through, two of them being of workable thickness. The improvement in the thickness and quality of the seams noted by Mr. Robinson augurs well for their value when struck at a greater depth. From the information given to me, I gather that the abandonment of these prospecting works was due to the difficulty of keeping down the water, and the indisposition of the owners to go to further expense, rather than to any want of faith in the value of the coal. It is quite likely that still more seams will be found lying beneath those already discovered, and prospecting the strata further by means of the diamond drill is strongly recommended.

So far as the section goes the strata do not appear to be getting any flatter in their dip as we get away from the greenstone. In view of this, I would advise that the first bore executed should be not more than five chains from the outcrop in the river, in place of ten or fifteen chains as formerly recommended. Nevertheless, I still expect that the seams will be found to dip at a much lower angle as they are followed further to the westward. The depths at which the drill strikes the various seams will show if any such flattening is taking place.

The most serious difficulty to be apprehended in testing and working this coal field is that, owing to the proximity of the greenstone intrusions, it is very likely to be broken by faults. It will probably be fonnd that at least three bores will have to be put down before evidence as to this point will be forthcoming. But, should payable seams be proved to exist in a disturbed condition near to the greenstone, there is still every reason to hope that, in the large stretch of sandstone country to the south-west of the outcrop, unbroken areas of considerable extent will be found. There is no doubt in my mind that this locality is well worth the expense of prospecting with the diamond drill.

I have, &c.

A. MONTGOMERY, *Geological Surveyor.*

The Secretary of Mines, Hobart.

Diamond Drill No. 1.

REPORT of Strata passed through in boring for Coal in the neighbourhood of Spring Bay.

No. 1 Bore.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface soil	1	0	1	0
Dark sandy clay	9	0	10	0
White running sand	1	0	11	0
Sandy clay merging into sandstone	3	0	14	0
Soft sandstone	2	0	16	0
Very firm grey post	3	0	19	0
Sandstone, some of it mottled	15	0	34	0
Firm grey post	1	0	35	0
White, sharp, quartzose sandstone	11	0	46	0
Sandstone, getting firmer	25	8	71	8
Coarse-grained, sharp, quartzose sandstone, varying in colour, hard and soft bars	23	4	95	0
Dark brown sandstone, brittle and firm	5	0	100	0
Light grey sandstone	5	0	105	0
Soft coarse-grained decomposed felspathic sandstone, charged with iron pyrites	8	9	113	9
Yellowish green to greyish greasy soapstone, changing in going downwards to dark greenish rather hard soapstone, and finally into diabase greenstone, of which the soapstone is a decomposition product. Joints at 117′ full of concretionary spherules of carbonate of iron	3	6	117	3
Diabase greenstone, fine-grained and decomposed towards the top, but rapidly getting firmer and also of coarser grain. Zeolites in joints and cavity at 162′ 6″	57	6	174	9
Total	174	9	174	9

Bore commenced 25th February, 1891; finished 20th March, 1891.

No. 2 Bore.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft, clay and drift	13	0	13	0
Soft brown sandstone	1	0	14	0
Hard brown sandstone with vertical iron veins	13	0	27	0
Very hard dark shale	1	0	28	0
White shale	0	6	28	6
White brittle sandstone	2	6	31	0
Very hard white shale	1	5	32	5
Hard white sandstone	1	0	33	5
Green sandstone	6	6	39	11
White sandstone	0	4	40	3
Very britile grey quartzose sandstone with vertical fracture	1	2	41	5
Hard quartzose white sandstone	4	7½	46	0½
Hard bluish-grey compact flinty sandstone or quartzite, with conchoidal fracture	0	8	46	8½
Compact grey sandstone or quartzite with almost vertical joints	1	8½	48	5
Hard greenish sandstone with vertical joints much like diabase greenstone in appearance. Altered felspathic sandstone	27	8½	76	1½
TOTAL	76	1½	76	1½

Bore commenced 1st April, 1891; finished 15th April, 1891.

No. 3 Bore.

Strata.	Thickness		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft, heavy boulder wash	23	6	23	6
Sandstone, with coal stains and fern prints	1	6	25	0
Dark greasy shales	7	6	32	6
Dark and light shales	2	8	35	2
Coarse grained friable quartzose sandstone, somewhat micaceous, much stained with carbonaceous matter	10	11½	46	1½
Soft grey post	8	4	54	5½
Black carbonaceous mudstone or clod	0	8½	55	2
Hard white flinty quartzose sandstone, approaching to quartzite	0	5	55	7
Coarse grained very friable dark coloured quartzose sandstone	0	2½	55	9½
Black shale or clod	0	6	56	3½
Soft sandstone with minute fossils	1	1	57	4½
Dark sandstone with calcite	1	3	58	7½
Light and dark sandstones	3	6	62	1½
Black carbonaceous mudstone or clod, with a little coal	0	4	62	5½
Light grey soft shale or claystone	3	1½	65	7
Sandstone with coal stains	4	10	70	5
Light blue shale	1	1	71	6
Light grey argillaceous fine grained sandstone and grey shale	5	0	76	6
Pink shale, iron stained	7	0	83	6
Light sandy shale	5	3½	88	9½
Sandstone	1	3	90	0½
Light blue shale	5	1	95	1½
Light grey shale or fine grained felspathic sandstone, with calcite interlaminations	6	0	101	1½
Dark firm shale, with calcite veins	4	11	106	0½
Dark blue shale	1	6	107	6½
Very dark shale	0	9	108	3½
Light blue shale	11	0	119	3½
Blue shale or fine grained felspathic sandstone, with fern impressions	2	0	121	3½
Shale varying in character, partly coal-stained grey post or hard fireclay	1	6	122	9½
Pink shale	6	11	129	8½
Firm sandstone	1	6	131	2½
Pink shale	2	0	133	2½
Sandstone	6	2½	139	5

No. 3 Bore—*continued.*

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Brownish felspathic sandstone and shale	3	0	142	5
Conglomerate of sandstone and pink shale	0	10	143	3
Brown shale and grey grit	4	1	147	4
Light bluish grey and pinkish and dark bluish grey arenaceous shale. Impression of *Phyllotheca sp.* at 154 feet	16	8	164	0
Soft sandstone	2	6	166	6
Shales, pink, blue, and sandy	5	0	171	6
Micaceous light grey felspathic sandstone, with coal stains ; a few inches of conglomerate in last foot	33	9	205	3
Hard white flinty quartzose sandstone	4	0	209	3
Fine grained quartzose sandstone, light grey and pinkish, passing into silicious mudstone, with carbonaceous matter	11	4	220	7
Slighly micaceous fine grained sandstone and arenaceous shale. Fine print of *Thinnfeldia sp.* at 230 feet, fragmentary prints of *Thinnfeldia* and *Phyllotheca* at 227 feet and 225 feet	14	0	234	7
Arenaceous shales and quartzose sandstones with prints of *Phyllotheca* and *Zeugophyllites*	13	0	247	7
Pink and light blue fine-grained quartzose sandstone and arenaceous shale ...	34	4	281	11
Pink shales	5	1	287	0
Green quartzose sandstone, light coloured in places	51	10	338	10
Red sandstone, quartzose, and sharp to touch	1	9	340	7
Green sharp quartzose sandstone, with included lumps of mudstone, forming a conglomerate for a few inches at 394′ 6″, getting hard at 419 feet	82	1	422	8
Solid, very dense, aphanite diabase greenstone, with conchoidal fracture	1	4	424	0
TOTAL	424	0	424	0

Bore commenced 25th April, 1891 ; finished June 12th, 1891.

No. 4 Bore.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft	8	0	8	0
Yellow sandstone, with coal markings	22	0	30	0
Blue sandstone, with coal markings	38	0	68	0
Dark shale	1	8½	69	8½
Coarse-grained sandstone	1	4	71	0½
Coal and shale	0	2	71	2½
Brown shale	1	5	72	7½
Dark shale	1	0	73	7½
Blue shale	3	0	76	7½
Sandy shale	7	7½	84	3
Coal	0	1	84	4
Black clod and coaly matter	1	0	85	4
White shale, with thin coal pipes	0	10½	86	2½
Coal (did not form solid cores)	2	3¼	88	5¾
Brown band	1	0	89	5¾
Black clod	0	10	90	3¾
Coal	0	7	90	10¾
Clod	0	3	91	1¾
Coal	0	3	91	4¾
Black shale	0	3	91	7¾
Sandy shale	1	7½	93	3¼
Soft sandstone	6	3	99	6¼
Dark shale	2	9½	102	3¾
Clod and *coal*	0	2¼	102	6
Sandy shales, with patches of clod	27	6	130	0
Hard white coarse-grained quartzose sandstone, approaching to quartzite	27	0	157	0

No. 4 Bore—*continued.*

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Greasy black clod, with thin seam of *coal*	1	0	158	0
Sandy shale	3	0	161	0
Hard white quartzose micaceous sandstone, with coal stains and thin pipes	3	6	164	6
Sandy shale and sandstones, with patches of clod, full of coal stains	6	6	171	0
Sandstone (quartzose) and shale, variable	7	4	178	4
Dark shale	2	0	180	4
Light band	0	8	181	0
Dark shale	1	0	182	0
Light band	0	3	182	3
Dark shale, with a trace of coal	1	3	183	6
Black clod	4	1	187	7
White shale	3	3	190	10
Coal	0	1½	190	11½
Sandstone, light and dark	5	9½	196	9
Very impure *coal* and black clod	0	4	197	1
Dark shale	3	8	200	9
Sandstone	2	11	203	8
Sandstone and shales, the latter getting lighter in colour	20	4	224	0
Sandstone and shales, two very thin seams of *coal*	15	0	239	0
Light grey fine-grained argillaceous sandstones, with pinkish tinge	22	10	261	10
TOTAL	261	10	261	10

Bore abandoned at 261′ 10″ as having passed into strata already tested by No. 3 bore.

ANALYSIS OF COAL FROM 88 FEET:—

Fixed carbon	52·2	per cent.
Matter volatile at red heat	12·8	„
Mineral matter (ash)	29·4	„
Sulphur	0·9	„
Moisture	4·7	„
TOTAL	100·0	per cent.

Analysis by Mr. W. F. Ward, Government Analyst.

Bore commenced 23rd June, 1891; finished July 18th, 1891.

REPORT ON THE HYDRAULIC LIMESTONES OF MARIA ISLAND.

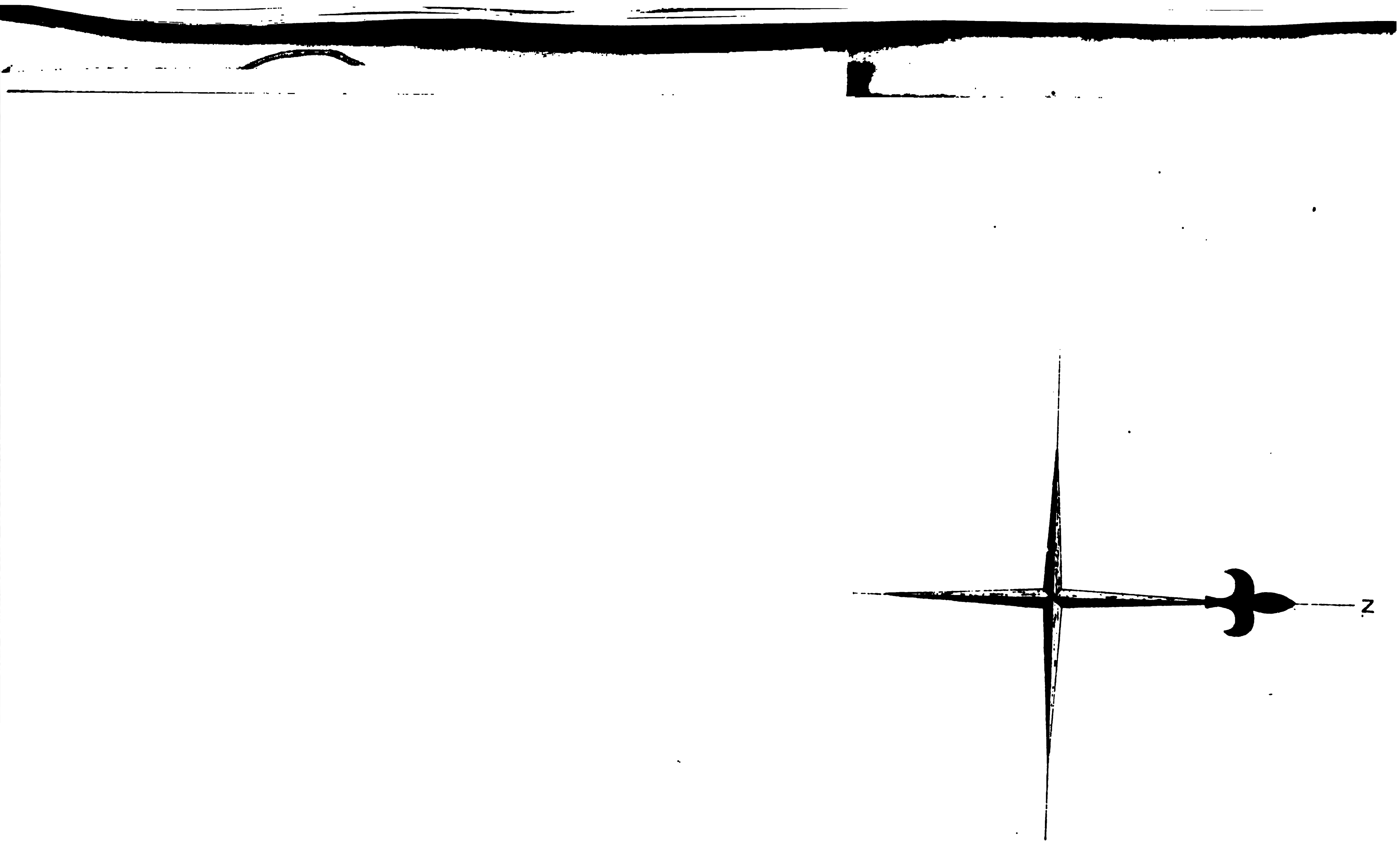
Geological Surveyor's Office,
Launceston, 19*th September,* 1890.

SIR,

I HAVE the honor to report, in accordance with your instructions, on the occurrence of hydraulic limestone suitable for the manufacture of Portland cement at Maria Island.

The ground examined is the property of the Maria Island Company, and is situated in the north-western corner of the Island. A plan and two sections of it are appended to this Report, and will be frequently referred to in it.

Geological features.—As will be seen from the map, the western part of the ground is composed of greenstone, similar in every respect to the great greenstone masses of the mainland, well seen in the gorge of the Prosser's River, above Orford, immediately opposite Maria Island. This igneous rock cuts off the limestone formation along a line indicated on the plan. Eastward of this line the country consists of beds of limestones and shales, reaching at any rate to Cape Boulanger; further to the eastward the greenstones and granites again cut them off. The north coast line affords a magnificent section of the strata, as vertical cliffs rise sheer from the beach to a height of as much as 400 feet. It is noteworthy that the ground slopes inland from the top of the cliffs, so that we have the unusual sight of ridges and valleys rising to the coast line instead of falling towards it. This topographical peculiarity is of importance in determining the site for the proposed cement works.



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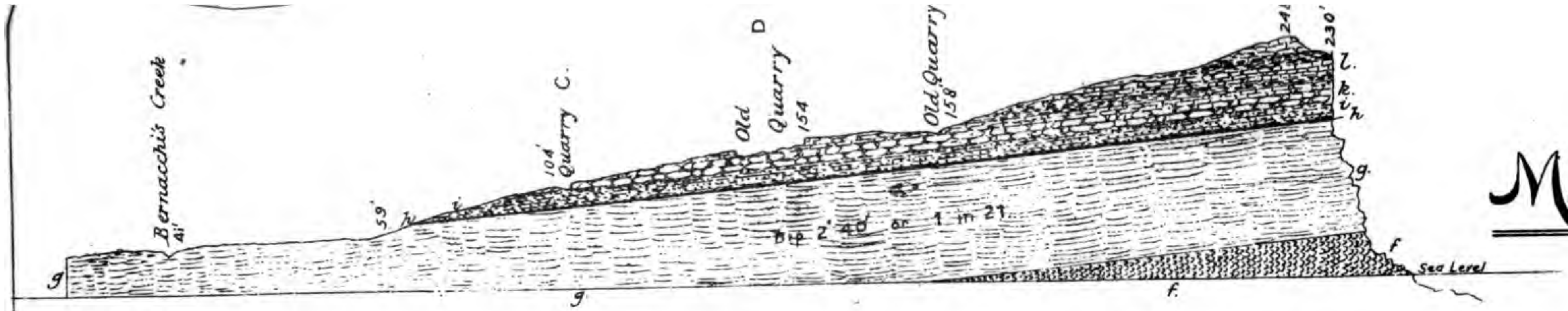
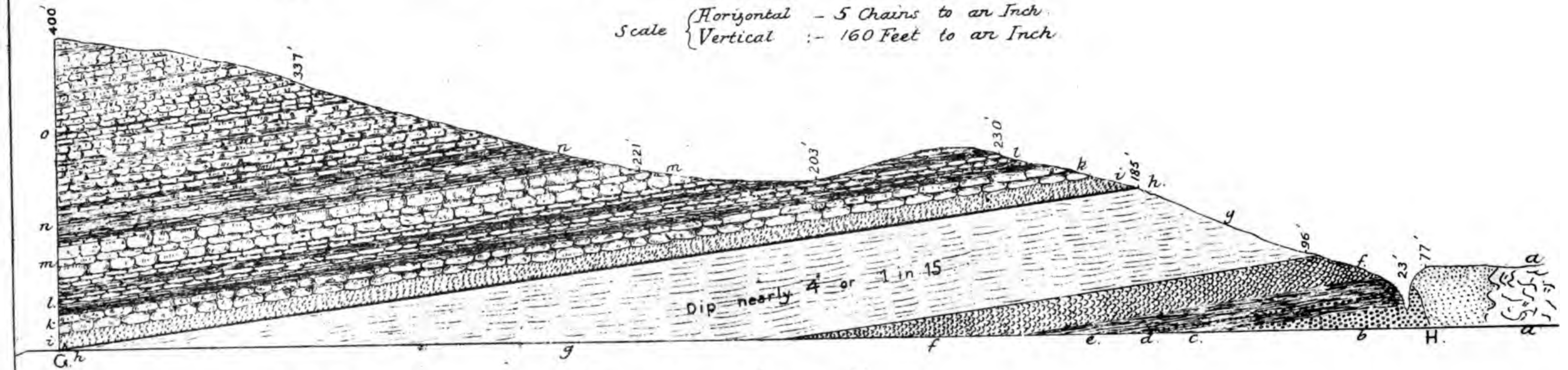


SECTION THROUGH MIDDLE SPUR FROM CREEK TO COAST

Scale {Horizontal – 5 Chains to an Inch
{Vertical :– 160 Feet to an Inch



SECTION ALONG COAST FROM G. TO H.

a. Greenstone. b. Limestone & conglomerate. c. Calcareous shale & thin beds of limestone. d. Bed of Pachydomus shells.
e. Calcareous shales with thin beds of solid limestone. f Thick bed of Pachydomus shells. g. thick bed of mudstones with very abundant remain
of species of Fenestella &c. h. bed of volcanic ash. i shaly limestone with numerous species of Spirifera, Productus &c. k. thin bedded ha
limestones worked in quarries on Middle Spur. l. horizon of limestone beds worked for cement in quarry A. m. horizon of crystalline crin
limestones in bottom of quarry B. n. mixed beds of limestone and mudstone. o. beds of hard limestone seen in face of cliff at G.

It has become customary, locally, to speak of the bands of hydraulic limestone as "Blue Lias," from the superficial resemblance of the stone to the bluish hydraulic limestones of the Liassic period in England. This is quite a misnomer, however, as the Maria Island beds are much older than the Lias, being of carboniferous age; they belong to the lower marine beds of our carboniferous system, which underlie the oldest coal seams yet found either here or in New South Wales. They are extremely rich in fossil remains, the most important of which are named in Johnston's Geology of Tasmania; the genera *pachydomus*, *aviculopecten*, *spirifera*, *productus*, and *fenestella* are very abundantly represented. Owing to the extreme steepness of the cliffs it is not possible to examine the section presented by them so closely throughout as is desirable, but I was able to compile the following section from observations in such parts as could be scaled. It is yet very imperfect, especially in the upper part, where the face of the cliff could only be closely examined by a person lowered over it by ropes. The section includes the strata seen between points G and H on the plan. The direction of the dip is a little more to the south than the line joining these points, being about S. 28° E., but the amount of the angle of dip is low, being only 4°, and the coast line section may be fairly considered as along the line of the dip. The beds in the cliff, therefore, come down to the beach, but cannot be clearly followed there on account of the great amount of fallen débris. The figured section appended shows the main features, but is on too small a scale to show details such as are now given:—

	Thickness.		Description of Beds.	Total Thickness of Strata.	
	Feet.	Inches.		Feet.	Inches.
Crinoid Zone.	320	0	Limestones consisting chiefly of crinoid remains in beds from 6 inches to 4 feet thick, separated by thin shaly partings. This limestone seems very pure, except that it frequently contains bands and masses of chalcedony (*Buhrstone*) formed by the infiltration and segregation of siliceous solutions. The beds of the large quarry at B. on plan belong to the lower part of this series	608	0
Productus Zone.	30	0	Beds of blue hydraulic limestone 6 inches to 4 feet thick, worked in quarries at A. C. D. E. and F. on plan, separated by beds of calcareous shale and mudstone, amounting, probably, to nearly half the whole bulk of the beds. The limestones show fossils of *aviculopecten*, *spirifera*, *productus*, and *fenestella* in abundance; *pachydomus* common, but less frequent. Small stones not uncommon	288	0
Fenestella Zone.	43	0	Shaly limestones, very rich in *spirifera* and *productus*	258	0
	2	6	Dark shaly mudstone	215	0
	1	9	Volcanic ash or tuff, very hard, full of small glittering granules of glassy quartz, felspar crystals common, also fragments of various rocks: decomposes to a yellowish-brown clayey stone, which still shows the glassy quartz granules very distinctly	212	6
	124	0	Mudstones with but little lime, very rich in species of *fenestella*, *stenopora*, &c.	210	9
Pachydomus Zone.	40	0	Thick limestone bed, almost entirely made up of shells of *pachydomus globosus*, but containing a great deal of sand and large stones	86	9
	6	0	Calcareous shale	46	9
	0	9	Solid hard limestone	40	9
	2	0	Calcareous shale	40	0
	2	6	Limestone and shale with *spirifera* shells and a good deal of gravel	38	0
	1	6	Solid hard limestone	35	6
	5	0	Calcareous shale	34	0
	1	6	Solid hard limestone	29	0
	1	6	Calcareous shale	27	6
	5	0	Limestone, almost entirely composed of shells of *pachydomus*	26	0
	1	0	Calcareous shale	21	0
	2	0	Solid limestone	20	0
	1	6	Limestone full of boulders	18	0
	3	6	Calcareous shale	16	6
	4	0	Limestone with a great many stones in it	13	0
	4	0	Conglomerate of boulders of metamorphic slate and sandstone and granite, cemented together by limestone	9	0
	5	0	Impure limestone with boulders	5	0
			Sea Level	0	0

The section is best read from the bottom upwards. The lowest beds, about 87 feet thick, have been aptly called the Pachydomus zone by Johnston in his Geology of Tasmania, on account of the immense number of shells of this genus found in it. It is overlaid by mudstones, forming a bed about 124 feet thick, characterised by extreme abundance of Fenestella fossils. This may be called the Fenestella zone *par excellence*, though this genus is abundantly represented from bottom to top of the section in all the shaly beds separating those of limestone, as well as in the latter themselves. The bed of volcanic ash or tuff, which lies on top of the Fenestella mudstones, is about 21 inches thick; it is found at the foot of the high cliffs just above high-water mark, about 10 chains west of point G. on the map; again, half-way up the face of the steep slope at the head of the deep little arm of the sea, about a quarter of a mile further west; and again, at the top of the cliff some five chains still further on, at an elevation of 185 feet above sea level. From its peculiar character, quite distinct from any of the associated beds, it will serve as a valuable datum line by which to recognise the stratigraphical position of the beds further inland.

The next zone of limestones overlying the tuff is characterised by great abundance of shells of Spirifera and Productus, and might be called the Productus zone; it is probably about 75 feet thick in all. The succeeding beds of limestone, seen in the section to be at least 320 feet thick, containing very numerous fragments of crinoid stems, may be called the Crinoid zone. While it is convenient to divide the strata into these zones, the prevalence of certain genera throughout the whole of them, and of the most characteristic fossils of one zone in those both above and below it, make it very doubtful if, in the present state of our knowledge, it will be possible to relegate the strata found further inland to them with any certainty. The division is proposed as a provisional one, pending more close examination of the fossil contents of the beds.

It is worthy of note that the boulders found abundantly in the lowest strata are all of metamorphic slate and sandstones and granite; I was not able to find a single greenstone boulder among them, though this rock is now close alongside. This is evidence towards the conclusion that the greenstone is of later formation than the strata of the lower marine carboniferous beds, and that the latter were not deposited on the flanks of greenstone masses as has been contended.

Manufacture of Cement.—The quarries opened to procure limestone for burning have as yet been confined to the lower beds of the Crinoid zone and those below it down to the zone of the Fenestella sandstone. The limestones of the Pachydomus zone have not been worked. It has been suggested that it would be a good plan to build any future works for the manufacture of cement near point H. on the map, and obtain the limestone from the adjacent cliffs. Examination of the details of the Pachydomus zone in the above section will show that for 47 feet above sea level the limestone exists in thin beds separated by bands of shale, and that the largest beds of limestone are full of boulders, which render them quite unfit for cement manufacture. Operations would be necessarily confined to the 40-foot bed of Pachydomus shells. This also contains much sand and gravel, and I doubt very much if it would be found fit for making cement. Its value in this respect can only be ascertained by breaking down and grinding a very large parcel of the stone, say four or five tons at least, and having analyses made of the powder, or, better still, having the ground material burned in a cement kiln by a practical man. Both tests should be made before deciding on this bed as the source of the raw material for the cement manufacture. As this limestone dips under the Fenestella mudstone the quantity of it that could be readily got out, though very large, is yet much less than could be obtained from the beds higher up. Further, the use of this bed would necessitate either hoisting the stone to the works, or having it carried by a tramway along the steep face of the cliffs for probably six or seven chains before a site for works could be obtained lower than the bottom of this limestone, which is only about 47 feet above the sea. Still another objection is that almost the whole of this bed at the point where it appears is on the Crown reserve which fringes the shore. Owing to the dip of the strata the bed is at such a depth as to be useless by the time the Company's ground is reached. Even if this limestone should prove to make good cement it is therefore very unlikely to be worked. The low ground near the engineer's house appears to me to be a much better site for the works than on the north coast; they could then be situated below the quarries, but close to them. Little more than half a mile of tramway, over easy ground, with a grade of not more than a foot in a chain, would connect them with the jetty; and they would be able to be supplied with water from the old reservoir up the creek. The outflow pipe of this reservoir is about 126 feet above sea level, and the top of the embankment about 140 feet. By repairing and raising the embankment, which could be done without very large cost, a fine water supply could be obtained, delivering water to the works under a head of over 50 feet at the least. This water supply could only be brought on to the north coast site by a long race round the western side of the high greenstone hill shown on the plan. The middle spur, on which quarries C. E. D. and F. are situated, will be the best source of the raw material; and I should say that the works should be on the point of the spur below point C. The top of the mudstones would naturally form the bottom of the quarries, and gives thus the approximate level of the hoppers for the stone-breakers. Between this level and the low ground south of the engineer's house there is both fall and space for a large system of works, through which the material could pass from higher to lower levels by gravitation, or with but little handling, to the tramway at the bottom.

The cement made hitherto has been from stone obtained from the quarry at A, with the exception of a little from the one at C; the product was of about the same quality in each case. Owing to the dip of the beds, the stone worked at A will not be found in the southern part of the middle spur, but should come in above the quarry at F. From below C to above F, therefore, it is probable that all the limestones will be of a hydraulic character. The cuttings in the old quarries at E, D, and F, show limestones of exactly similar appearance to that in A and C; though I am not aware that any practical test has been made of them. These limestones are in beds averaging about a foot to eighteen inches in thickness, though often much thicker, and are separated by thin layers of shales; this will render the quarrying extremely easy, though there will necessarily be a good deal of refuse shale to be got rid of; this can be readily run to spoil in the valley on the west of the spurs. Some of the calcareous shale may be found useful to correct the excess of carbonate of lime which is likely to be found in some of the limestone beds. Without much more accurate surveys than have yet been made, it is impossible to form any close estimate of the quantity of material here available, especially as we cannot yet tell what proportion of the whole will have to be rejected; but I do not think that a million tons would be too high an estimate of the probable quantity of limestone in the spur between C and the coast. Still more can be obtained along the base of the spur which runs from the point G down to the quarries at B. The upper part of this spur is all composed of the Crinoid limestones seen in quarry B, which are of too pure carbonate of lime to be of use except in small quantities for correcting any deficiencies in lime that might be found in the lower hydraulic beds. The latter dip under the Crinoid strata, and the amount of stripping would be too great to allow them to be profitably followed into the hill to any great distance; but all the lower ground round the foot of the spur could be worked from near the coast to the present kilns and on up the creek for a long distance. The supply of raw material easily reached is therefore practically unlimited.

All the conditions appear very favourable for advantageous and cheap working, provided that the quality of the hydraulic limestones is uniform and suitable; this has yet to be ascertained. The owners have satisfied themselves that the cement made from quarries A and C is of first rate quality. This is not a question for me to pronounce upon, and the reports of the specialists who have examined and tested the cement must speak for themselves; if they are as favourable as I was informed they were, what has been proved is that one of the lower, (C), and one of the higher, (A), beds of the strata of hydraulic limestone has been shown to make good cement. As to the intermediate beds we know nothing, except that they appear to the eye to be identical with those tried; this is not, however, sufficient proof to warrant the expenditure of a large capital. It is now necessary to open up the whole bed of probable raw material from top to bottom, by means of cuttings into the middle spur at various levels, or by means of shafts sunk along its course; in cases of this sort analyses of small samples are more likely to be delusive than useful, and so sufficient quantities must be taken to give practical working tests which will prove the average value of the stuff. With the machinery on the ground as it is, it would be no difficult matter to practically test a parcel of, say ten tons, of limestone taken as evenly as possible from all the various beds. The stone should be put through the stonebreaker and mills and reduced to powder; the bulk of this should be bricked and burned at some well known and reliable cement works, and small parcels analysed. The opening of the beds by such a test would also give an approximate estimate of the amount of refuse shale and mudstone that will have to be rejected, thus allowing a fair estimate to be made of the quantity of material that can be got from a given area, and the cost of winning it; the expense of making it is, of course, considerable, but it would be most rash to erect expensive works without so doing.

I would recommend open cuttings and shafts for testing the ground rather than drills, unless, indeed, enough bores were executed to secure enough weight of cores for a working test, as it is of the utmost importance to secure samples which will fairly represent the average composition of the mass. In order to produce cement of a uniform quality it will be necessary to have uniformity in the raw material. This contains occasional stones, shells, and shale bands, which cannot be got rid of altogether before going into the grinding mills. It will have to be managed so that the percentage of deleterious materials will never exceed a certain amount. Taking a large sample for the preliminary tests will be the only way to secure that the deleterious substances are duly represented, and are not either in excess of or below the average. In actual working it will doubtless be arranged that the stonebreakers will be fed from a large paddock of broken-out limestone, brought indiscriminately from all parts of the quarries, so as to keep the material always of the average composition. It is important that the preliminary tests should be of material as near as possible to this average composition. I lay great stress on these matters, because it is not always understood by the general public how continually varrying is the composition of any given limestone bed, and how essential it is for good working that the material treated should be of uniform quality.

Disturbances of the strata.—Among the numerous troubles frequently arising in working such deposits as those under consideration, the occurrence of faults in the strata is often to be numbered. In the present case there does not appear to be any reason to anticipate that any such will be found, the beds being, as far as can be seen just now, quite undisturbed. In the top of B quarry, however, there are signs of flexure of the strata to a small extent, which is probably only local. The test pits and cuttings above recommended would settle this question also. Should faults be found to occur it is quite conceivable that a different arrangement of the works would be required from that which would be otherwise adopted. This is not likely, but still possible.

Buhrstone.—Throughout the Crinoid limestone beds occur numerous irregular bands and masses of cellular chalcedony, very similar to buhrstone. On the beach below the high cliffs large quantities of this may be seen, and flat pieces of considerable size are common. If this stone should prove to have a commercial value for milling purposes there would be no difficulty in obtaining it in considerable quantities. I cannot speak as to its practical value.

Taking into consideration that good cement has already been made, and that there are extremely good facilities of all sorts for making and shipping large quantities of it, there is every reason to hope that this important industry will soon be established and flourish in Maria Island.

I have, &c.

A. MONTGOMERY, *M.A.*, *Geological Surveyor.*

The Secretary of Mines, Hobart.

REPORT ON THE PROGRESS OF THE MOUNT ZEEHAN AND MOUNT DUNDAS SILVER-LEAD FIELDS.

Geological Surveyor's Office, Launceston, 25th November, 1890.

Sir,

In accordance with your instructions, I have again visited the Mount Zeehan and Mount Dundas Silver-Lead Fields, and have now the honour to report on the progress visible since my former visit in March last, and on the state of the fields generally. I shall frequently have to refer to my previous "Report on the State of the Mining Industry on the West Coast" of 25th April last, as the present Report is supplementary to it.

Mount Zeehan District.

The progress made in the Mount Zeehan District has been rather in surface work than in developing the lodes. This is largely owing to the fact that in most instances the mines have to be equipped with drainage machinery before sinking on the lodes is possible. In such cases as it has been possible to work by means of adits, steady underground mining has been carried on with more or less success. Where sinking must be done, it has not been possible to get the necessary plant owing to the very wet weather that has prevailed. This made the road from Trial Harbour to Zeehan impracticable for heavy loads, so that boilers, engines, and pumps could not be brought from the coast even when they could be landed there, which has been far from often. At best only comparatively light machinery can be imported by this route, and as this would have soon to be replaced by more powerful plant, it is better for the owners of mines to get the latter in the first place, even though this course involves awaiting the completion of the Strahan-to-Zeehan Railway. Some of the companies, it is true, have at great expense got drainage machinery up from the coast, but the necessity for more powerful plant has been exemplified lately in the case of these same mines, the Silver Queen and Argent mines having been flooded out, while the Mount Zeehan (Colonial) Company has barely been able to keep the water down by working the engine much above its proper speed. It is quite clear that economy demands the erection of powerful engines at once, and that small temporary ones are only thrown away. The difficulties with water experienced last winter are very largely due to the great amount of rainfall, and during the summer they may may be expected to be much less troublesome. As the surface of the ground becomes cleared, drained, and grassed, so that the rain water will not lie on it, but run away into the watercourses, less water will be found underground. The clearing and drainage of the sections is therefore of considerable consequence, and should be pushed on with when other work is slack.

The Township of Zeehan has grown very much, and buildings are going up in every direction, proving the faith of the residents in the future of the field. Tracks have been made to most of the sections, and if a great deal of prospecting has not always been done, preparations for it in finer weather have thus been undertaken. On a large number of sections prospecting has been carried on in spite of all difficulties, and on some with great energy and vigour. There are still, however, too many of them on which absolutely no work has been done. The popular excitement over the discoveries at Mount Dundas causing attention to be diverted from the older field, has doubtless been responsible for some of this neglect, but it is also indubitable that some of the lessees have no intention of working their ground until they are forced to do so. Everywhere there is plenty to do that ought to be done without delay. Even if ore cannot be raised for want of engines, there is a great deal to be done in tracing the lodes, preparing machinery sites, cutting and sawing timber for buildings, making roads and tramways, and generally preparing for getting briskly to work when the railway is ready to bring in the machinery.

In my former Report I have referred to the volcanic rocks found throughout the Zeehan District as being in most cases probably dykes of a rock allied to diorite. The new work in Balstrup's, the Manganese Hill, and the Silver Queen mines, and the extensive prospecting trenches and tunnels of the Silver Queen Extended Company, have, however, thrown much new light upon the subject, and I am now of the opinion that these masses of clayey rock are really, in most instances, tuff-beds lying between the beds of silurian slate and sandstone conformably, and therefore being, like the latter, frequently inclined at high angles of dip. In the clayey rock between the two lodes in the Western mine a bed of volcanic breccia containing scoriaceous fragments has been found dipping almost vertically. In the second crosscut in Balstrup's mine the bedded structure of the tufaceous rock is also very apparent. On the Maxim section it is very clearly seen, the beds being thin and of different colours and textures. One of these, of very white colour and standing vertically, had been trenched upon, and was about to be further exploited by an adit in the belief that it was a kaolin lode. These tufaceous rocks must have been deposited in the waters of the silurian sea, partly probably as showers of volcanic ashes falling upon the water, and partly as ashes washed into the sea in immense quantities immediately after eruptions, at the time when what are now slates and sandstones were being deposited as sediments. It is quite possible, and probable, that flows of lava and the intrusion of dykes accompanied the pouring forth of showers of volcanic ashes, and consequently some of the volcanic rocks now found may prove to be of the former nature. As the workings of the mines extend, the relationship of the volcanic rocks to the slates and sandstones will doubtless become more clear. The question is one to be studied with practical interest by miners on the field, as a radical difference in the country rock in which lodes occur is extremely likely to be accompanied with a difference in their ore contents.

The following brief notes on the various properties visited will show the progress that is being made. Many sections are not here mentioned at all, as I had not time to go to them, though I believe that I visited almost every one on which any work of consequence was being done, the only exceptions I know of being the Silver Duke, Oonah, and Junction Companies' holdings, on all of which work was going on, but which I could not make opportunity to go to.

Silver Queen.—(Sections 1666M., 1636M., 1641M., 1642M., 1637M., 1638M., 1639M., and 1640M., Visited 11th October, 1890.)

Work from the main shaft in Section 1637M. has had to stop on account of the mine being flooded. This disaster has been compensated for by the discovery of a new and very rich lode on Section 1638M. This was first cut on the side of the main road, 2·64 chains from the west and 7 chains from the south boundary of the section, as a mere seam of whitish clay, but on following it it increased in width and soon showed carbonate of lead rich in silver. The drive on it goes N. 40° E. for 142 feet, then N. 68° E. for 38 feet. In this the lode averaged about 20 inches in width, varying from 12 to 30 inches. Excellent high grade ore was obtained for about 140 feet, when the country changed from tufaceous rock to black slate, and the lode became pinched and the ore dipped underfoot. Since my visit a winze has been sunk at this point and a drive southward, that is, back towards the mouth of the first adit, has been constructed. I saw several bags of ore from this, consisting mostly of galena crusted with cerussite (the carbonate of lead). It was very pure ore, and, according to the Company's bulk essays, very rich in silver. I was informed that the lode in the winze and drive had widened out to from 3 feet to 3 feet 6 inches. The ore in the upper drive was at first mainly cerussite, containing some blue and green carbonates of copper, a little quartz, and some clay, but as work progressed a good deal of galena made its appearance. The lode is evidently making into galena at no great depth. At the time of my visit 98¾ tons of high grade carbonate ore had been sent to Trial Harbour for shipment, and since then a great deal more has been sent. The purity and high silver value of the ore in this lode have made the discovery a most valuable one, and if the shoot goes down to a depth, as it may fairly be expected to do, it will be a real Bonanza for the Company. When I saw the workings it appeared as if the ore was going to be confined to the tufaceous country. It will be very interesting and instructive to notice if it goes into the black slate country at a greater depth.

The course of this lode should carry it into Section 1639M. In this another tunnel has been driven north through hard tufaceous rock from a point eight chains from the south, and six chains from the east boundary of the sections. On the surface of the ground above the tunnel there is a great deal of loose brown iron ore, and a piece of carbonate of iron carrying galena and blende was found just at its mouth, so that there is reason to believe that there is a lode in the near vicinity. A small vein of iron-stained clayey matter crossing the drive yielded a few bags of ore assaying 54 ounces to the tons in silver, and assays show that the country rock itself carries a little of the precious metal.

The discovery of the cerussite lode on this property has been of great service to the Zeehan field by recalling public attention to it when all eyes were fixed upon Dundas. It has also led to a great deal of prospecting being done, especially in the tufaceous formation. Numerous assays have shown that this rock often contains a small quantity of silver, and it is therefore likely to prove a good matrix for rich lodes.

Balstrup's Manganese Hill—(Section 1209M. Visited 11th October, 1890).

This mine shows a great improvement since I last saw it. At 370 feet from the mouth of the adit a crosscut has been put in to the north, which struck the lode, six feet wide, at from 12 to 18 feet, and was then continued to a distance of 240 feet without any further result. The country was turfaceous rock all the way. An airshaft 130 feet deep having been sunk on the lode where struck by the crosscut, a drive on the lode easterly was then begun, and had been driven 195 feet when I saw it. In this the lode proved to be from six to eight feet wide as a rule, and consisted of iron and manganese oxides, with occasional crystals of cerussite, but not payable. In the face a change had just come in when I saw the mine, the ore having changed to carbonate of iron with lode-slate and strings of galena, though the latter was not yet in payable quantity. Some antimonial lead ore, assaying from 114 to 120 ounces of silver to the ton, was also found here, and the width of the lode increased to 15 feet. From the frequent occurrence of cerussite crystals in the gossany portion of the lode, together with their absence in the outcrop on surface, the inference may be drawn that the lode is improving at a depth. The assays of the stuff from the drive, too, show a considerable impovement in their silver returns over those of the surface stuff. It appears as if during the alteration of the lode-matter of the outcrop under the influence of surface waters and their dissolved gases, which resulted in the formation of iron and manganese gossan, both lead and silver have been leached out and probably carried to a lower level. Where the atmospheric influence stops at or about the water level, the lode will probably be found to be enriched by these solutions from the higher portions. A winze is to be sunk shortly in the floor of the drive on the lode to try if the lode continues to improve with depth. As galena and carbonate of iron have been found in the drive, it is possible that as it gets further into the hill a considerable portion may be found to be unaffected by surface oxidation, and good ore may be stoped from above the tunnel level; but should the gossan extend down to water level it is extremely likely that the good ore will lie rather below the tunnel. Should this prove to be the case the mine will have to be worked from a shaft.

A second crosscut has been made to cut the lode, starting from a point 806 feet from the entrance to the old adit. It was in about 200 feet when I saw it, but had not yet reached the lode. It passes through a turfaceous rock containing fragments of slate in places.

In my former Report, and the map attached thereto, I find that through some mistake I have marked Balstrup's lode as running S.W. and N.E., whereas it should be N.W. and S.E., the outcrop running through the south boundary of the section, about 4 chains from the S.E. corner, and then running on through Sections 724-87M and 741-87M. It is very strongly marked, the ironstone often rising into a high ridge or wall.

This mine looks very promising, and I have great hopes of its turning out well. As it is typical of a large number of gossan lodes in the Dundas District, its further development will afford much information as to their probable behaviour in depth.

Despatch—(Section 243-87M. Visited 12th October, 1890.)

No work is just now being done upon this Section, which is in very low wet ground. A lode which, from its bearing and position is very likely to be the Silver King lode, is cut in it in several trenches. Course N. 35° W. It passes through the northern boundary of the Section, about 2½ chains east of the N.W. corner-peg, running into Section 1666M of the Silver Queen Company. It is from 3 to 7 or 8 feet wide in the various trenches, shows gossan and galena, and has been traced almost through the section.

The Silver Queen lode in Section 1666M, mentioned in my former Report, crosses the north boundary of this Section about 7 chains east of the N.W. corner-peg. As the course of this is only 15° to 17° W. of N. it should run into the first-mentioned lode about 10 chains south of the north boundary line. This should be a good mine when opened, but will require plenty of power to deal with the water which accumulates on the surface in the wet season.

Silver Crown—(Sections 197-87M, 198-87M, 199-87M, 201-87M, 736-87M. Visited 12th October, 1890.)

The tunnel in Section 736-87M, mentioned in my former Report, has since been driven to within 40 feet of the shaft, without striking the load. The shaft is down 56 feet, and has yet to be sunk 24 feet to connect with the tunnel. When the connection has been effected the lode in the shaft will be followed, and judging from the quality of the ore obtained from the shaft, the stopes should produce payable galena. As the lode in the shaft has varied very much in size, and been at times much split up, some work must be done before the quantity of ore that can be raised can be estimated.

No other work is going on upon these sections, which are mostly open swampy button-grass land. A good deal of trenching has been done with sufficiently favourable results to show that the ground deserves better than to be let lie idle. It appears to me a most promising property. In Section 197-87M, about 4½ chains from the east and four chains from the north boundary, a lode, said to be 7 or 8 feet wide, was cut in a trench now full of water. The ore is galena, with a gangue of siderite (carbonate of iron). This lode requires further tracing. The Silver Queen lode of Section 1666M is likely also to be fouud in this section, and Section 201-87M ought almost certainly to have the Despatch lode. In Section 197-87M also their is a large outcrop of ironstone, carbonate of manganese, siderite, and oxide of manganese, carrying a little galena, situated about 5 chains north of the middle of the south boundary. As far as can be seen from the trench, the width of lode is about twenty feet, and its course N. 32° E., but the latter is not at all clear. There are four or five veins, carrying galena, cut in trenches close to this large lode, and a little further to the north there are several others. As the trenches were full of water I could see nothing of the size of these. Nothing can be done to test this ground without machinery to drain the workings, but it appears to me that the prospects warrant giving it a thorough trial.

Silver Crown Extended—(Section 848-87M. Visited 12th October, 1890.)

A great deal of trenching has been done in low ground on this Section, without much result, except the finding of a little loose galena associated with blende. The depth of the loose surface soil and the wetness of the ground have prevented the lode, if there is one, from being found in solid country. The galena found in the trenches appears to be taking a course about N. 2° W. The indications here are as yet not very promising, but perhaps in the dry season it might be possible to sink a few feet on the galena veins and learn if they become more defined.

Western—(Sections 755-87M, 756-87M, and 854-87M. Visited 12th October, 1890.)

Work in this mine has been steadily carried on since I last reported upon it. The lower adit is now 502 feet, the country passed through having been all curly black slate. In the upper adit, the No. 2 lode has been driven on for 187 feet. At 100 feet it split, and the eastern leg was followed for 87 feet, but at 65 feet from the split the lode dipped away under foot. A crosscut was then put in to the westward a distance of 58 feet, where the other leg of the lode was cut. This was from one to three feet wide. In the crosscut several veins of galena one quarter inch to two inches thick were cut through, all dipping westerly towards the main vein. This has now been driven on for 16 feet, and, though small, furnishes a fair quantity of very good galena. The country rock is tufaceous. On the No. 1 lode the northern drive has been extended to 131 feet in hard black slate. The lode is now very small, only showing about three inches wide in the face.

The manager informs me that altogether 96 tons 3 cwts. of ore have been exported from the mine, 33 tons having come from No. 1 lode, 56 tons from No. 2 lode, and 8 tons from No. 3 lode. About 50 tons of second-class ore from No. 2 lode are now on the surface. In spite of the high charges for freight to Trial Harbour, the ore exported has returned enough profit to pay for the mining work that has been done.

The drive on No. 2 lode has yet to be extended some 200 feet before connection can be made with the lower adit. This will require a winze 40 feet deep. From the lower tunnel to the surface there will be about 94 feet of backs on the lodes, so that a large quantity of ore can be got from the stopes. Should the adit strike No. 2 lode carrying ore there will be a length of over 300 feet of it to be stoped to surface from the upper level. This mine has very fair prospects before it.

Mount Zeehan Silver-Lead Mine—(Sections 559M and 909M. Visited 13th October, 1890.)

On Section 559M underground work has been pushed on with at the 120 and 60 feet levels. Water has been very troublesome, and the pumping engine has had to be run to its utmost capacity. A much more powerful one is urgently required. The lodes have been rather poor, though occasional bunches of ore have been obtained. The manager estimates that he has 80 tons of first-class ore and about 400 tons of second-class at grass. This mine is being well worked, and deserves greater success than it has yet had. I feel confident that it will be a large producer of ore in time.

Manganese Hill—(Section 724-87M. Visited 13th October, 1890.)

In this property an adit is being driven from the lowest level obtainable to cut a large outcrop of ironstone and oxide of manganese which runs through the north-east corner of the Section, and is almost certainly part of Balstrup's lode. The tunnel had been driven 470 feet at the date of my visit to it, and had yet to go another 200 or 250 feet to reach the lode. The country is easy for driving, being clayey, vertically bedded turfaceous rock, often enclosing angular fragments of brittle slate. Till the lode is cut nothing can be said as to the future of this mine. The outcrop is of a favourable nature, and there is good likelihood of ore being found at a greater depth. It remains to be seen if the adit is low enough, or if it will be necessary to have a shaft.

The Silver King—(Sections 217-87M, 218-87M, 219-87M, 220-87M, 221-87M, 222-87M, 223-87M, 468-87M, 469-87M, and 470-87M. Visited 14th October, 1890.)

So far as work on the lodes is concerned, this property is just as it was when last reported on. all energies have been devoted to getting the winding and pumping machinery erected at the main shaft After great difficulties and expense this has now been practically completed, and sinking and exploitation of the lode should now proceed rapidly. The erection of machinery was not quite completed when I visited the mine, but was nearly so, and the formal starting of it has since been reported in the newspapers Should the lodes in depth come up to the promise of the surface prospects, this Company should soon be paying dividends.

Silver Bell—(Section 480-87M. Visited 14th October, 1890.)

The tunnel on the lode in this excellent little property has been extended to connect with the shaft. I was so unfortunate as to visit the mine when all the men had gone away for some reason, and consequently could not get accurate information as to the distance driven. A large quantity of splendid-looking ore is stacked on the surface, and I quite believe the current report that its value is nearly, if not quite, equivalent to the nominal value of the mine as shown by the price of the shares. The drive has been in ore throughout its whole length, and ore is known to be underfoot, therefore ready to be taken out when drainage machinery shall have been erected and a lower level can be driven. This mine gives promise of being one of the best on the field.

T. L. Fowler's Section—(547-87M. Visited 14th October, 1890.)

In this section a lode, which from its position and mineral character has been conjectured to be Balstrup's has been cut by trenches in two places in low-lying ground. In neither trench has the outcrop been completely cut through, but it is evidently a wide one, quite 20 feet of it showing in the trenches. The course of the lode as taken from the trenches is about N. 25° W., which is much too northerly for Balstrup's lode, but may be only local. The outcrop contains a great deal of carbonate of manganese in rose-red crystals, also oxide of manganese, and a good deal of carbonate of lead. As Balstrup's lode is characterised by richness in oxide of manganese, which would result from the oxidation of the carbonate, the large quantity of the latter found in Fowler's lode favours the belief that they are identical. Nothing has been done on this property for some time, and it will require machine drainage before the lode can be worked to any depth. It appears to me to be well worth developing.

F. G. Duff's Section.—(1148-87M. Visited 14th October, 1890.)

A new find is here just being opened out. The lode is about 10 feet wide, and runs about north and south, as far as can be seen at present. A small adit has been driven to cut it. In this the lode is mainly made up of lode-slate mixed with galena, though the latter is not yet found in payable quantity. Where seen on surface, in the side of a creek, it is mostly siderite impregnated with galena and blende. Though nothing payable is yet in sight, the lode is worth prospecting.

Bell and Hall's Sections.—(419-87M., 420-87M., 421-87M., and 422-87M. Visited 14th October, 1890.)

Very little has been done to this since I last saw it, only a few trenches having been dug. In these nice crystals of carbonate of lead are freely obtainable in the gossan. Course of lode N. 30° W. The prospects of this lode are much too good for it to be lying idle as at present. A geological point of great interest occurs on this ground. In the bottom of a trench through some loose masses of ironstone, at the main outcrop near the centre of the property, I found a magnesian limestone containing fossils belonging to the marine beds of the coal measures; fragments of a *stenopora* being most common. It is probable therefore that a portion at least of the flat ground in the valley, in which these sections lie, is occupied by strata belonging to the coal measures, instead of the usual silurian rocks. What extent of these latter rocks there is will be known only when some more work has been done on the ground. I do not anticipate that there is more than a small patch; but as I subsequently found coal-measure strata in the vicinity of the Big Henty River, it is quite possible that these latter rocks occur in several other of the low-lying valleys between Mount Zeehan and Strahan. As I found shales carrying fossil ferns beneath the marine beds at the Henty, it is quite possible coal may exist in the formation, and some of the patches of coal-measure rocks might prove valuable. An analysis of the limestone made by Mr. S. Cullingworth, assayer to Balstrup's Manganese Hill Company, was kindly given to me by Mr. J. F. Heighway. It was made to test its value as a flux for smelting, and was as follows:—

Lime, 34·35 °/o CaO.
Silica, 8·00 °/o SiO_2.
Magnesia, 10·89 °/o MgO.
Iron and Lead not estimated.

These figures indicate a percentage of carbonate of lime ($CaCO_3$) of 61·34, and carbonate of magnesia ($MgCO_3$) 22·87. Being low in silica, this limestone would prove useful if no better were available; a much better limestone has, however, been found on the Pyramid Company's ground.

Pyramid—(370-87M. Visited 14th October, 1890.)

Work has been abandoned for some time on this Section, presumably because machinery is required in order to sink on the lodes. Two strong lodes have been found and exposed in trenches close to the large creek which runs through the section. The larger of these two is quite 12 feet wide, course N. 65° E., dip to N.W. A vein of calcite over a foot wide runs along the footwall. The lode is composed of calcite, carbonate of iron, and galena, and has a distinctly banded structure. There is a splendid show of galena, well seen by the lode having been stripped for about 30 feet along its course. The second lode runs into the first; it is about 9 feet wide, course N. 25°W., and shows a large body of fair galena ore. It cannot yet be seen whether the two lodes join one another, or whether one crosses or is thrown by the other. The N. 25° W. lode runs into a high hill on the south side of the creek, and may perhaps be worked by an adit, but as it rises up the hill it appears to be much oxidised to gossan, and it may prove to contain ore only at or near water-level. On the north side of the creek I am not aware if this lode has been found. If it crosses the other lode at all it should be found on that side running into another steep hill suitable for tunnelling. There is a really fine show of galena ore in this property; I am informed, however, that it assays much below the average of the field in silver.

The stuff thrown out from a small shaft that had been sunk close to the intersection of the lodes consists of a very pure limestone of light yellowish-grey colour, apparently the country rock. One sample of it, assayed by Mr. Cullingworth, gave—

Lime, 52·2 °/o CaO.
Silica, 6·7 °/o SiO_2.
Traces of Iron and Magnesia.

The lime is equivalent to 93 °/o of carbonate of lime. Another sample taken by myself was analysed by Mr. W. F. Ward, Government Analyst, with the following result:—

Lime	51·1 per cent.
Magnesia	1·3 per cent.
Oxide of Iron	1·5 per cent.
Silica	4·1 per cent.
Sulphuric Acid (SO_3)	traces.
Carbonic Acid, moisture, and organic matter lost on ignition...	42·0 per cent.
TOTAL	100·0 per cent.

Mr. Ward says, "a minute quantity only of iron pyrites was found. Limestone of this quality would form an excellent flux."

These analyses show a very good fluxing limestone, and as it occurs close to the railway line it can be readily carried to wherever it may be required. This discovery will probably result in smelters being established on the field instead of at Strahan.

The Pyramid property is a genuinely valuable one, and only requires to be taken in hand by a Company strong enough to work it to become a large producer of ore.

Grubb's—(Sections 1562-87M., and 1580-87M. Visited 26th October, 1890.)

Almost no underground work has done on this ground since my last visit. From the drive on the west side of the creek a few tons of excellent galena and cerussite ore have been taken from the small lode encountered in it. A machine site has been levelled, and a main shaft sunk to the adit level, and poppet legs have been erected. A manager's house, office, and several other buildings have also been built, and all energies are now devoted to the construction of a tramway which is to connect the mine with the terminus of the Strahan-to-Zeehan Railway, on the Silver King Company's ground. This tramway is projected to be 3 feet 6 inches wide, with no steeper grade than 1 in 40, and no curve of less than 5 chains radius, being in these respects the same as the railway. If carried out on these lines it will be a very excellent tramway. I cannot, however, see the necessity of having so expensive a one in the present state of the mine; a narrow-gauge light tramway would answer all purposes for a long time. If the line is to be carried out as at present proposed it should be laid with heavier rails, the same as those on the main line, so that the railway trucks might run right up it without transhipment. The tramway will be close on 3½ miles in length; it will be of great service to many other Companies besides this one.

Tasmanian—(Sections 1468-87M., 1467-87M., 1469-87M., 1688-87M., 1470-87M. Visited 26th October, 1890.)

The work done on this property also since I last saw it is principally preparatory. A site for an engine-house has been levelled, and a main shaft 63 feet deep has been sunk and connected by a crosscut 55 feet long with the main adit. It is now proposed to bring a tramway in from the main road at the Comstock to the mine. On Section 1470-87M. a shaft has been sunk 78 feet through a clayey tufaceous rock full of green talcose particles. About 3 feet of the clayey lode formation containing pyrites and a little loose galena were passed through in this shaft, which is about 2 chains from the boundary of Section 1005-87M., and 10 chains west of the boundary of 1681-87M. It was sunk to look for No. 2 lode.

Block No. 1, *Britannia*—(Section 1005-87M. Visited 26th October, 1890.)

Some prospecting has been done on this section in the endeavour to pick up the Tasmanian Co.'s No. 2 lode. About a chain north of the south boundary an adit close on 300 feet in length has been driven due west; at about 130 feet from the mouth, about which distance the lode was expected to be met with, two small strings of quartz and pyrites were cut, but nothing more definite.

About a chain from the northern boundary some trenches have been dug in which quartz highly charged with pyrites and containing a few specks of galena has been got. Owing to water the trenches could not be sunk to any depth. The galena was rather more abundant towards the bottom of the trench. This Company has evidently yet to find its lode.

Mount Zeehan (Tasmania) Silver-Lead Mines, Limited. (Visited 26th and 30th October, 1890.)

This English Company holds nine Sections, which are generally known by the names of the Companies that formerly held them, but as some of these are still in existence, having sold only part of their ground, this nomenclature leads to confusion. The manager has, therefore, decided to call them by Block numbers, as follows :—

Block No: 1. 193-87M., formerly held by the Argent Company.
Block No. 2. 192-87M., ditto ditto.
Block No. 3. 1643M., ditto Silver Queen Company.
Block No. 4. 1665M., ditto ditto.
Block No. 5. 189-87M., ditto Silver Queen Extended Company.
Block No. 6. 196-87M., ditto Silver Spray Company.
Block No. 7. 195-87M., ditto ditto.
Block No. 8. 994-87M., ditto Britannia Company.
Block No. 9. 2154-87M., ditto Montana Company.

Since taking possession of these properties the Company has been working vigorously to get them into a producing state. A tramway is being made to the site chosen for the smelting furnaces, and bricks are being made on the ground for these and for general use. The machinery erected on Block No. 2 by the Argent Company has proved unequal to its work, the water rising in spite of the engine, so that underground work has had to be abandoned here for a time. The pumps on Block No. 5 are, however, at work, and sinking and driving are being proceeded with. A new shaft is also being sunk on Block 5, and is now down over 55 feet. This shaft is about 80 feet from a lode known as No. 4, and 55 feet from another known as No. 3. The former strikes N. 10° E., and the latter N. 55° E. They run together in the small creek passing through the Block. Both these lodes are small, but they show from 4 inches to 6 inches of galena frequently. The main shaft is situated 4½ chains from the north and 245 feet from the east boundary of the block. No. 1 lode is 100 feet west of the shaft; it shows a lot of galena on surface, runs N. 7° E., and is from 2 to 5 feet in width. About 386 feet further westward No. 2 lode is encountered. Some very fine galena was obtained from a small shaft on this, which is now full of water, preventing the width of the lode or its course from being seen ; the lode has not been trenched on surface, and its course is not certainly known, though supposed to be about N. 10° E. From No. 2 lode to the junction of Nos. 3 and 4 is about 400 feet. It is intended to drive a crosscut westward from the main shaft to the new shaft, cutting the various lodes; the new shaft will then serve as an air shaft.

On Block No. 9, the old Montana Company's section, the lodes have been stripped a good deal and better traced than when I last saw them, and a large quantity of good galena has been stacked. Work is progressing vigorously on this block.

On Block No. 8 nothing is being done at present. In this a lode containing galena and blende with much pyrites has been cut in a trench in about the position where the Tasmanian Company's No. 2 lode might be looked for, but the course was about north and south where I tried it with the compass. It is said to be three feet wide in the trench, but as the latter was full of water I could not verify this. Close to this lode is a large gossan outcrop, mostly composed of brown oxide of iron, into which a short tunnel has been driven without cutting through it. This ironstone is reported to have assayed well, and has evidently been thought worth saving, as there is a neat heap of it stacked outside the mouth of the drive. The gossan can be traced in a north-westerly direction on surface for a considerable distance.

From a conversation with Mr. Elliott, the manager of the British Company, I gather that the smelting furnaces will be of two types,—ore-hearths for treatment of rich pure galena, and water-jacket cupola furnaces for the re-smelting of the slags from the ore-hearths, and for less pure ore. Such ore as is too poor in lead for furnace treatment is to be concentrated by means of jigs and buddles. From the energetic way in which the Company is working it should be but a short time before the necessary plant is on the ground. The blocks of land secured comprise several of the best-looking "shows" on the field, and the Company should reap a rich reward for its enterprise.

E. Dardus's Section—(1635-87M Visited 27th October, 1890.)

In passing over this lease on my way to the Silver Stream, I noticed that several small gossan lodes had been cut in shallow trenches on top of a ridge. Nothing has been done to prove their extent, or if they carry anything of value.

Silver Stream—(1642-87M. Visited 27th October, 1890.)

Some trenches in low-lying swampy ground have obtained good pure galena in black surface soil, but at the time of my visit there had always been too much water to allow of sinking into the solid rock below. The galena in the trenches appears to be following a definite line, about N. 10° E., and in all probability a lode is close underneath. Some of the galena was said to have assayed 129 ounces of silver to the ton. In one of the trenches some ironstone was obtained containing native copper. A small shaft is being sunk to test the ground further. In another part of the section a tunnel has been driven 66 feet to cut across a continuation of the Tasmanian Prospecting Company's magnetite lode. The magnetite in this tunnel was very soft and friable ; no lead or silver ore was found with it. Should the loose galena be traced to a lode this property might turn out well ; when I saw it its success was quite problematical.

Tasmanian Silver Prospecting Company—(Sections 1919-87M., 2095-87M., 2096-87M., and 2173-87M. Visited 27th October, 1890.)

This Company must not be confounded with the Tasmanian Silver Mining Company, Limited, above mentioned. A large strong wide outcrop of magnetite of good quality runs in a north-westerly direction from Section 1642-87M., through 1830-87M. and 1919-87M. No work has been done for some time, and the old workings on the last-named section are now full of water and cannot be examined. Several small shafts and drives have been made towards the north end of the outcrop of magnetite. From the fragments of material lying on the surface it is evident that lode stuff, consisting mainly of quartz carrying pyrites and blende in large quantities was obtained from these workings, and I have also been shown fair samples of galena said to have been got from them. Even these, however, were much mixed with blende and pyrites. The load-matter from which the ore was obtained appears to lie on the south-west side of the magnetite lode. The country west of this is a highly matamorphosed slate, and a little further to the westward the granite of Mount Heemskirk comes in. I do not think it at all likely that the magnetite outcrop will prove to be the capping of a silver-bearing lode. The occurrence is a very interesting one from a geological point of view, and on that account I should like to see some sinking and driving done on it; but I very much fear that it will have no commercial value until some future day when iron ore can be profitably mined.

Comstock—(Section 712-87M. Visited 29th October, 1890.)

Work here has been confined to driving a tunnel to intersect the two lodes seen in the surface trenches. This is now in a distance of 580 feet. Bad luck was experienced in cutting No. 1 lode, in a spot where it was very large and very barren. The tunnel passed through crystalline dolomite, similar to the gangue of the lode in the surface workings, for 65 feet,—the rock containing a little talc, occasional strings and specks of galena, and some blende and pyrites. The walls are well defined, and there is also a large well polished slickenside in the middle of the mass. There can be little doubt that this really is the lode, and that it has been cut in one of the barren parts so common in all similar formations. It will now be necessary to drive along its course to the northward to get under the place where ore is known to exist in it. It is, however, the intention of the manager to push on the tunnel till No. 2 lode is cut, as the latter contains ore on surface almost above the tunnel. This lode should be almost at hand now. The country in the face is blue limestone, with white streaks, similar to that found alongside the lode in the large surface trench. Though this Company has been unfortunate in not striking ore in the lode at once, it should be remembered that the point where it is cut by the adit is a long way from the place where the good ore was got on surface, and there is no need to despair of ultimate success. I see no reason to alter my previously expressed opinion that this will be a good mine.

South Comstock—(Sections 803-87M. Visited 29th October, 1890).

Since my last visit to this property a very long prospecting trench has been cut up a small creek which runs down to the Comstock ground. A large mass of pyrites with some galena in it and some large loose pieces of good galena were obtained, but no defined lode. The country is much disturbed. There must be a lode somewhere in the vicinity, but further prospecting has to be done to find it.

Silver Queen Extended—(Sections 188-87M. and 187-87M. Visited 30th October, 1890).

In Section 188-87M. a tunnel has been driven 326 feet through rather hard slate country; it has to go 690 feet altogether in order to cut the first of a series of five or six parallel lodes that have been discovered in the creek running through the Section. Two of these are close together, not more than 20 feet apart; a short tunnel has been driven to cut these, and some surface trenching has been done on them in the bed of the creek. The first lode is from 4 to 5 feet wide, consisting chiefly of carbonate of iron carrying blende and galena, but not yet in payable quantity. The width of the second lode is rather indefinite; the country between the two is much impregnated with lode matter, so that it is probable that they will come together at no great depth: course N. 30° W. The main tunnel will strike these lodes about 100 feet below their outcrop in the creek, and, as the hills rise steeply on each side of the latter, a good height of backs should be available in them. Four other small lodes, running more or less north-west, exist higher up the creek about 11 chains from the eastern boundary of the section; nothing has yet been done on these, only their gossan outcrops having been noticed in the creek.

In section 187-87M. a great deal of prospecting has been done in the endeavour to pick up a continuation of the Silver Queen lode in Section 1638M.; the country is all the tufaceous rock above referred to. Just south of the south-east corner of 1638M. a tunnel 192 feet long has been driven due west nearly to the boundary of the Section; several small veins of ironstone were cut in this, one of which contained fine crystals of pyromorphite, which proved on assay to carry very little silver; this vein has a north-westerly course.

At a point about 420 feet west of the south-east corner of Section 1639M. and 56 feet south from the boundary line, a vein of somewhat siliceous black gossan was discovered, from 6 to 12 inches wide, running north-easterly; 20 feet east from this a shaft was sunk to a depth of 45 feet and a drive put in to the westward for 50 feet, which cut the vein again 24 feet from the shaft; nothing of value has yet been got from this vein, which in the drive from the bottom of the shaft is still as thoroughly oxidised as at surface. Going to the south-west the vein is found again in several trenches, now of much larger size, being from 6 to 9 feet wide. This is not unlikely to be the Queen lode; a new tunnel is to be started to cut it about 60 feet below where it is seen on the surface. It appears to be most necessary in this tufaceous country to get as low down on the lodes as is possible in order to have any chance of getting ore in them.

Sacramento—(Sections 1852-87M., 1287-87M., and 1288-87M. Visited 30th October, 1890.)

No one was working on these leases when I visited them; the only sign of work that I could see was one trench about three chains long near the boundary of the Silver Queen Extended and Sylvester Companies' Sections. A small vein, a few inches wide, of nice looking galena was cut in this trench, which is mostly through black slate.

Sylvester—(Sections 820-87M., 821-87M., 877-87M., 878-87M., 879-87M. Visited 30th October, 1890.)

Operations have been mostly confined to Section 820-87M. On this a lode running about N. 20° E. has been discovered, and traced by means of several trenches. The lode consists of clayey oxides of iron and manganese, and contains a good deal of pyromorphite poor in silver. Towards the south it appears to split into two branches, 2 ft. 6 in. and 5 feet wide respectively. Higher up the hill to the north it is about 6 feet wide. A shaft 14 feet deep has been sunk on it, but the lode soon dipped to the eastward and left it. Another small lode mostly of quartz, about one foot wide, is found running N. 20° W. a short distance west of the shaft. It should soon run into the first one. It is stained with oxides of iron and manganese, and contains a little pyrites. A tunnel is to be driven from the creek near the south boundary of the section on the main lode. As the outcrop rises rapidly up hill from the creek, this will test the lode to some depth.

Maxim—(Section 924-87M. Visited 1st November, 1890.)

Two lodes of carbonate of iron carrying galena are found near the centre of the section in very low swampy ground. One is about 18 inches wide, and strikes N. 35° W.; the other is 2 feet to 3 ft. 6 in. wide, and runs N. 20° W. The two should junction at no great distance from where they are laid bare. Some loose galena has also been found in black surface soil near the line of these lodes. There is not much galena in sight in them, but they are very promising, and well deserve a trial. Pumps will be required to sink on them. As previously mentioned, the supposed kaolin lode in the south of the section proved to be only a whitish vertical bed of tufaceous country.

Serpentine is found on the south boundary of this section, and I was told that it is also met with in Section 1148-87M. It carries a little galena on the faces of the joints, but nothing to speak of. Should the lode in Fowler's Section 547-87M. be indeed Balstrup's, it can hardly fail to pass through the north-east corner of the Maxim ground: it is worth looking for. The section has good prospects on the whole.

Percy Fowler's Section—(1055-87M. Visited 1st November, 1890.)

About 5 chains north and 3½ chains east from the N.W. corner of the Maxim section an outcrop of ironstone is found, under which a short tunnel has been driven, cutting a lode of carbonate of iron showing galena freely, though not in payable quantity. The thickness and course of the lode are not ascertainable till some more work has been done. Should it prove to be a north-westerly lode, it will probably be connected with the Maxim lodes. There is, however, another large outcrop of ironstone, carrying a little galena, in the side of the Manganese Creek, close to the north boundary of the section. Should this be part of the same lode as the first, its course would be about N. 40° E. This outcrop is, however, much in the position where Balstrup's lode might be expected to be found. It is evident that a lot of prospecting has yet to be done on this section to prove what it really possesses. It has a very good show, and deserves to be worked with vigour, instead of lying idle as at present.

MOUNT DUNDAS DISTRICT.

In my former Report on this District I expressed the opinion that "a detailed examination of it twelve months hence would be quite soon enough to give an idea of its value." In this opinion I still remain, for so little has been done in opening up the lodes that there is in most cases little except surface indications to examine, and these, while giving good grounds for sanguine hopes as to the future of the mines, do not allow anything to be predicted of them with an approach to certainty. An immense number of outcrops of iron and manganese oxides have been discovered all over the field, but in only a few instances has work proceeded far enough to show what like the lodes underneath them are. When a good many more of these gossans have been sunk and driven through, evidence will be forthcoming to form a judgment of the probable value of the still unproved ones, but now any estimate is pure guesswork.

There is no reason to fear that good ore will not be found under the ironstone—rather is it likely that it will be; but every mining district has local peculiarities, and until something is known about these it is premature to be positive as to the behaviour of the lodes. During the next six months of dry weather, if work on the claims is carried on with energy, a good basis of facts will be laid on which a judgment can be founded with some confidence. The most important contributions to our knowledge of the Dundas lodes as yet have been derived from the tunnels of the Mount Dundas, Macstri Broken Hill, Comet, and Adelaide Proprietary Companies, to which we may add Balstrup's at Mount Zeehan, as it is a precisely similar occurrence. In all these instances tunnels have been driven into the lodes from low levels, very little above the probable water-level of the localities. In the Adelaide tunnel, and to a small extent in Balstrup's, unoxidised ore—viz., carbonate of iron and galena—has been found after getting well into the hills enclosing the lodes. In Maestri Broken Hill tunnel galena and cerussite were found, together with a little carbonate of iron, but the bulk of the lode stuff was thoroughly oxidised. The same was the case in the adjoining tunnel of the Comet Company, only that galena and carbonate of iron were not found above water-level, and carbonate of lead was not obtained till a winze had been sunk nearly to it. In the Mount Dundas Company's tunnel, though 200 or 250 feet below the outcrop on the top of the hill, the lode-stuff was found to be thoroughly oxidised. Chromate of lead in fine crystals was found, but no galena or even carbonate of lead. These instances would seem to show that many of the large gossan lodes may be expected to be thoroughly oxidised down to the water-level, and as it appears certain that one result of this is the leaching of the silver and lead contents from the oxidised portions, the latter may be expected to be almost barren except near the water-level, where, however, it is very probable that they will be rich, the enrichment being the result of the deposition at water-level of the metallic contents dissolved from the oxidised upper parts of the lodes. The celebrated Broken Hill (N.S.W.) mines appear to be thus enriched, the gossan outcrop of the lode being as a rule poor in both lead and silver, while in the bottom the galena and sulphide ores found are also poorer than the intermediate rich zone of carbonate of lead and chloride of silver ores. Should it prove at Mount Dundas that the large lodes are thus oxidised down to water-level, most of the mining will have to be done from shafts, and the advantages of natural drainage will be lost. This thorough oxidation is more likely to take place in the case of large wide lodes than in that of narrow ones, the former offering greater facilities for the passage through them of the water which with its dissolved gases is the cause of their decomposition. Several instances can even now be seen in the field that show that the smaller lodes at any rate are not altogether changed to gossans. For example, high on the slope of the hill south of the Comet property a lode has been struck (in Section 2297-87M.) showing galena almost on the surface. When this is traced on to the top of the hill (in 1796-87M.) it is nothing but gossan without a trace of lead. This is at a height of 63 feet above the galena, which itself is 315 feet above the water-level shown by the adjacent workings of the Comet and Maestri Broken Hill Companies. It is clear that in this instance, though oxidation has begun in the lode, it has descended to no depth to speak of. The same will probably be the case with many other of the narrower lodes, and very likely with some of the wider ones as well, so that the exceptionally good facilities of the field for drainage by means of adits will not be thrown away, but be here, as elsewhere, a strong recommendation in its favour.

The Dundas field has been enormously extended of late, and is still widening day by day. Great numbers of the sections are not yet surveyed, and consequently nothing has been done to develop the lodes upon them. On most, therefore, the gossan outcrops are seen in their natural state, quite undisturbed, and any conclusions that may be drawn as to the value of the ground and the future of the mines must be deduced from their appearance alone. This is not enough to go upon, further than to warrant the spending of some money in sinking and driving to ascertain what lies beneath. Finding that this was the state of the field I did not attempt to visit one-tenth of the total number of sections, but contented myself with seeing such as had something done upon them, or as I could learn were best worth going to. The majority even of the surveyed sections had no one working upon them, and as there are very few tracks it is a matter of impossibility for a stranger to find the lodes, supposing him to be able to find the sections themselves to begin with. The dense bush covering everything makes this no easy matter. A great deal of track-cutting will have to be done before underground work can be begun. The Government track north from the Zeehan-Dundas road to the Pieman River will be an immense convenience to the district, and the sooner it is widened and formed into a road the better it will be for all concerned. I am not at all sure that a horse tramway would not be as cheaply made as a road, and it certainly would be more easily maintained, for some years at least. From the configuration of the country this must be the main road through the Dundas and Pieman River field, numerous branches connecting it with the mines. The difficulty of getting tools and supplies to the claims is retarding the development of the mines exceedingly, everything having to be carried in on men's backs at present. The labour of thus getting in such things as a blacksmith's forge, with its anvil, bellows, and grindstone, is so great as to be deferred till the last possible moment; yet no driving can be done without a forge for sharpening picks and drills. Combination among the owners of sections is greatly required in the work of cutting tracks. This should be set about without delay, so as to be finished before next winter. If not hurried on with there will be next to nothing done before wet weather is again set in, when progress will be both difficult and expensive to make. On the present summer's work it depends whether the field will be really opened in 1891, or left practically idle for another year or more.

Leaving Mount Zeehan on the 15th October, I went to the northern portion of the Dundas field first. This is most easily reached by going out through the Despatch, Silver Crown, and Western sections on to the open button-grass country, where a northerly course is followed for two or three miles to the edge of the bush. Through this a foot-track has been cut by Mr. Meredith, the original prospector of this northern part of the field. This is a fair foot-track, but requires to be made passable for packhorses before much work can be done on the claims. As it is the best way of getting to a large number of valuable sections, I would recommend that the widening and improvement of it be taken in hand by the Government. It is doubtful if the above-mentioned track northward to the Pieman River from the Zeehan-Dundas road will come near enough to these sections to be of much benefit to them. Having spent a day in looking at several discoveries in the north, I then came south-east and south through a number of sections not yet on any published chart of the district, though several of them have been surveyed, passing through Fletcher's, the Caledonian Company's, Renison Bell's, Robb and Webster's, Glock's, the Madam Melba Company's, and other sections to the North Dundas Company's Camp. From here I went to the Great Nevada property, and thence south along Moore's new track to the main road from Zeehan to Dundas, by which the centre of the Southern Dundas field was reached. It is rather a misnomer to call the northern portion of the field by the name of Mount Dundas, as it is on the basin of the Pieman River, and quite away from even the base of Mount Dundas. As sections are now being taken up on the north side of the river also, it might be well to call the whole of this the Pieman River Silver Field. The mineral belt appears to be running northward straight for the Heazlewood and Whyte River fields, and there seems every probability that it will extend right through.

As showing how entirely undeveloped the northern field yet is, I may say that between the Pieman River and the South Dundas field I saw only four places where there was any payable ore in sight. These will be mentioned presently when the various sections examined are described in detail. Large numbers of gossan lodes were, however, seen, and from their great size and length there can be little doubt that important discoveries will be made beneath the ironstone. Most of this yields two or three ounces of silver to the ton on assay, which gives promise of the improvement of the lodes in depth. I did not, however, see any lead minerals in these outcrops, except in the few cases above referred to where galena was in sight.

In these, carbonate and phosphate of lead were found in the ironstone close to the galena, but higher up the gossan was barren in them. This is favourable to the idea that good ore exists under the other gossan outcrops; for if we find that a lode which shows galena where cut through in the bed of a creek passes rapidly into barren gossan as we ascend the hills on each side, it is safe to expect that similarly barren gossans will have galena below them in depth in like manner.

There can be little doubt that the unoxidised gangue in the lodes below the ironstone caps will prove to be carbonate of iron, just as in lodes on the Zeehan field. This mineral has been struck under the gossan in the Adelaide Proprietary tunnel, and shows along with the galena in some of the northern sections. Another reason for predicting its occurrence in depth is that the ironstone outcrops frequently contain pseudomorphs of brown iron oxide after siderite, that is, crystals of brown iron ore which have the characteristic shape of carbonate of iron (siderite) cystals, and have been formed by the slow oxidation of the latter. Where they are visible it may be assumed that the oxidation of the outcrop does not descend to any considerable depth, and that carbonate of iron, and with it its close associate galena, will be found a short distance below the surface. I noticed this feature more commonly in the lodes of the Pieman River district than in those of South Dundas, and infer from it that the former will be found to be less oxidised in depth than the latter. Some of the prospectors call these pseudomorphs "tomahawk iron," from the resemblance of the crystals to the blade of an axe.

Reviewing the whole field, I do not think that there can be any question that we have here a very extensive and valuable mineral district. From the rugged and heavily timbered nature of the country it will necessarily be some time before the mines can be opened up so that an estimate can be formed of their ore-producing capabilities, and a still longer time before they are in a position to send steady supplies of ore to the furnaces. The great number of the lodes is itself against the rapid development of the ground, as the available capital becomes distributed in small amounts over a large number of mines, instead of being concentrated on a few of the best. This has the advantage, on the other hand, of leading to the prospecting of a greater number of the lodes, from which it will better be found what ones are best worth further expenditure. I may here take this opportunity of referring to a practice which is much too common, of floating companies with a large nominal capital, of which only perhaps £2000 or £3000 is available for working the mine. The promoters receive large interests in paid-up shares, and often considerable sums in cash besides. The amounts thus paid are usually quite out of proportion to the value of the mines as calculated on any sound basis of valuing. They are in fact such "fancy" prices as the high expectations of the promoters may excite them to ask, and the enthusiasm of the public for fashionable stock may tempt them to give. No matter how good a mine may be, if the owners cannot cannot bring it themselves into a paying condition, it is of little value to them. They must therefore be prepared to make sacrifices to attract the required capital. Where the future of the mine is a matter of speculation the price that should be paid for it ought really to be very small, as there is only a chance in a lottery to pay for. If the original holders of the ground are recouped for their time, trouble, and expenses in securing it, and get a large interest in anything of value that may be found, and further secure that enough money to open the mine properly is spent upon it, they receive all that any fair valuator can consider due to them as a price for it. If it turns out well they participate largely in the profits, if badly, they suffer no loss. There have been a few glaring instances of rapacity lately on the part of promoters of companies at Mount Dundas that lead me to draw attention to this matter. In the best interests of the district it is necessary to protest against the way in which the money that should go to working the mines is diverted into the pockets of these men. The field cannot get on without money being freely spent in working it, and cannot pay a penny in dividends till it is worked, and it is therefore absolutely essential that capital should go into the mines, and not be thrown away in buying out the rights of first holders. The public are greatly to blame in giving the high prices asked for, especially as they generally do so on the exaggerated representations of the promoters themselves, and without any thought of the probable cost of bringing the mines into a paying condition. Perhaps the reiteration of the fact that very few of these properties can raise at the present time one hundredweight of payable ore, and that their value is entirely prospective and speculative, may help to impress upon the public mind the necessity of requiring that the bulk of the money subscribed should be spent on the ground in mining work. These remarks must not be construed to mean that there is nothing of any value at Mount Dundas—far from it. The indications and probabilities of the existence of great mineral wealth are extremely good, only it has to be mined for, and consequently money must be put into the ground. It is only by doing so that it can be ascertained which of the lodes are valuable, for among such a number it is in the nature of things that there should be many worthless. When the lodes have been proved to contain payable ore, it is quite time enough to pay large prices for interests in them. I have to take some trouble to say that I am not running down the Dundas field, for my last Report was construed by some writers in the public press into a condemnation of the whole of the West Coast districts, which it most certainly was not. If I do not extol its prospects to the extent that is often done, it is because it is good enough to stand on its merits without any such aid. There is much more to be feared from the evil results of "booming" the field than from a simple exposition of how matters stand. A "boom" is sure to be followed by a reaction and depression; and while anxious to see capital going into the mines, and believing that it will yield a good profit if properly applied, I should be very sorry to see the properties raised to absurd prices by the fever of speculation.

I shall now give a few notes on the sections visited. In a few instances the applications had not been surveyed, and it is within the bounds of possibility that in some of these the lodes will be found to come within the leases of previous applicants. The applications are often so close to each other that when the surveys are made there is no ground left for the later applicants.

Sections 2522-87M *and* 2523-87M. (Held in the name of Henry Gore. Visited 16th and 17th October, 1890.)

On these sections a very fine lode is exposed in a creek near the boundary line between them, in two places, about two chains apart. It has not been cut through so that its true thickness can be seen, and this is somewhat difficult to determine from the outcrop, as the lode dips easterly about 55°, and at the same time crosses the creek diagonally, so as to appear larger than it really is. As nearly as I could judge, it is from 10 to 12 feet wide. Course N. 15° to 17° W. The lode appears to be made up of several bands, the largest being from 3 to 4 feet thick. Splendid fine-grained galena is seen in thick bands in the exposed section, and payable ore could be at once knocked out. Some of this galena contains antimony, and gives very high assays, one of over 1800 ounces to the ton having been obtained from it. The gangue of the lode is quartz, siderite, and iron pyrites. This has every appearance of being a stong permanent lode. On the south side of the creek it can be traced up the hill to a height of about 63 feet, the outcrop changing into an ironstone gossan, with no lead ores showing in it. Close to the galena, however, pyromorphite and cerussite occur plentifully. As the creek falls rapidly, I do not think there would be any difficulty in getting a tunnel from it to cut the line of lode 50 or 60 feet below the outcrops of galena. A large quantity of ore could be obtained by driving on the course of the lode from where it is cut by the creek. This discovery gives excellent promise of making a good mine.

In another creek on Section 2522-87M, some 7 or 8 chains S.E. from the above, a lode formation 10 or 12 feet wide, and striking about N. 30° W., is found. Nothing has been done to prove this, but in all probability it is part of the same lode as the last-described. One seam 8 or 10 inches wide in it shows galena freely.

Section 2470-87M. (Held in the name of Henry Gore. Visited 16th October, 1890.)

Some 8 or 10 chains north from the centre of the southern boundary of this section there is a very large outcrop of iron and manganese oxides, with a good deal of quartz. The strike of the deposit is not yet determined. The gossan outcrop is close on 300 feet above the level of a creek close by it, so that the lode could be easily tested by an adit.

Sections 2471-87M *and* 2473-87M. (Held in the name of Henry Gore. Visited 16th October, 1890.)

About the centre of the boundary line between these two sections a lode about 5 feet thick has been found in a creek, consisting of siderite and carbonate of lime, with galena, blende, and iron pyrites disseminated through these. Course N. 10° W., dip westerly. In Section 2471-87M, what may be the same lode is again struck, but not exposed sufficiently to make out its course. Some nice loose galena was here obtained. So far these lodes are not payable, but deserve further examination.

Towards the centre of the same section a lode of carbonate of iron is cut, showing about one foot thick, and containing some galena. Course N. 65° W., dip towards N.E. This requires to be further stripped and trenched upon. The country here is limestone, itself carrying a little galena.

Sections 2492-87M *and* 2493-87M. (Held in the name of Henry Gore. Visited 16th October, 1890.)

At the western end of the boundary line between these sections, and on the east boundary of 2470-87M, a large strong outcrop of brown iron ore, 10 to 12 feet or more wide, has been found, containing numerous pseudomorphs of limonite after siderite ("tomahawk iron.") Course about N. 14° W. About 5 chains E. from the centre of the W. boundary of Section 2582-87M another ironstone outcrop is said to occur on the line of this lode, and another again in the centre of Section 2472-87M. I did not see these two outcrops, but can rely on the information as to their existence. The lode where I saw it appeared to be strong and well defined, and I should quite expect that it would extend into Sections 2582-87M and 2472-87M.

Section 2529-87M. (Held in the name of T. C. Fletcher. Visited 17th October, 1890.)

A huge outcrop of gossan is found in the centre of this section, and running to the S.E. from it through the middle of the two sections of the Caledonian Company, 2548-87M and 2578-87M. It is said to have been traced for nearly two miles. Course about N. 75° W. The gossan is composed of brown oxide of iron (with "tomahawk iron"), some oxide of manganese, and a good deal of quartz. This should be a very large lode, and ought to be tested without delay.

Section 2547-87M. (Held in the name of T. C. Fletcher. Visited 17th October, 1890.)

This section lies immediately to the south and south-east of 2529-87M. In the centre of it a large ironstone outcrop with a course N. 20° W. shows very clearly for about two chains. It is said to have been traced for more than a mile. The gossan consists, as usual, of iron and manganese oxides with quartz. No work has yet been done on it.

Sections 2956-87M *and* 2663-87M. (Held in the names of R. T. Moore and F. Burns respectively. Visited 17th October, 1890.)

In cutting the boundary line between the two sections, about 8 chains from the N.E. corner of Burns' section, a lode was discovered by the surveyors. It consists of about six feet in width of carbonate of iron and galena with a little oxide of iron, oxide of manganese, and carbonate of lead. A trench has been cut across it revealing galena in what is probably payable quantity. The course of the lode is not distinctly seen, but appears to be about N. 40° W. and with a north-easterly dip. From its position this might well prove to be part of Meredith's galena lode found in Sections 2522 and 2523-87M. The lode is in somewhat low ground, but probably 50 feet of backs could be obtained upon it without much length of an adit. It looks very well, and deserves early development.

Sections 2537-87M, 2536-87M, 2534-87M, *and* 2535-87M. (Visited 17th October, 1890.)

These sections were not surveyed when I saw them, and with several others were applied for by the Renison Bell Prospecting and Mining Company, No Liability. They extend in a south-easterly direction from east of Section 2578-87M of the Caledonian Company's previously mentioned. They have been taken up so that a large ironstone lode found on them will pass approximately through the centre of each section. The course of this lode is about N.N.W. The gossan in one of the sections forms a cliff quite 20 feet high, and is of great width. The lode-matter seems to be thoroughly oxodised to a great depth, for where it crosses a large creek it still shows as gossan without any lead minerals such as cerussite and pyromorphite. From this creek to the top of the hill towards the south end of the sections must be from 500 to 700 feet vertically. The lode can be easily tested by driving on its course from the place where it crosses the creek. From its great width and length this should prove a very important lode. The facilities for working it by adits are especially favourable.

Sections 2958-87M *and* 2959-87M. (Visited 18th October, 1890.)

The first of these two 80-acre sections is applied for by R. Webster and C. Robb, and the second by C. Robb. They were not surveyed when I visited them. They lie to the south and east of the Renison Bell's Co. sections just spoken of. A very large ironstone lode runs about N.W. and S.E. through these two sections, crossing the boundary between them at the centre of the line. The gossan consists of iron and manganese oxides, and in places cannot be less than three chains in width. The lode may be easily tested either by a drive on its course or by a crosscut. Its appearance is promising enough to call for a thorough trial. As a surface "show" it is quite equal to many of the best at South Dundas. The same might be said of the Renison Bell, Caledonian, and Fletcher's ironstone lodes.

Section 2566-87M. (Visited 18th October, 1890.)

This unsurveyed section is applied for by M. Glock. An ironstone lode, whose thickness I could not properly see, has been found in it, running through the centre of the section, about N.W. and S.E. The gossan is of a favourable nature. No work has been done to expose the lode.

Section 2567-87M. (Visited 18th October, 1890.)

R. Webster has applied for this section, also unsurveyed at the time of my visit. In a small creek on it a small gossan lode has been cut, said to be on the line of the above Glock's lode. The application notice is in the centre of the ground applied for, close to the place where the lode has been found.

Section 2595-87M. (Visited 18th October, 1890.)

This is in the name of W. M'Loughlin on the September chart of the Dundas District, but I understand that it, with several other adjoining ones, is held by the Madame Melba Company. The country rock in this vicinity is serpentine, thus differing from the sections previously described, which were all on slate and sandstone. About the centre of the section a fine lode has been cut in a small creek. It is 26 inches wide, and consists of almost solid antimonial lead ore (Jamesonite probably), with a little quartz, blende, and pyrites, and some blue calcite and green talc. Course N. 25° W., dip S.W. 80° to 83°. On the slope of the hill, north of the creek, it has been cut again 2 feet 6 inches wide, but composed entirely of iron and manganese oxides, with a little quartz. Though this lode is small, it is almost solid ore where cut in the creek; and if this continues for any distance it is quite large enough to give handsome returns to the owners. A tunnel can be driven from lower down the creek to cut the lode at a considerable distance below the outcrop. I unfortunately arrived on this section just after all the men working on it had left to go to the township, and consequently I was unable to find another lode that exists on the property. The antimonial lead lode, however, is of itself good enough to stamp the section as a valuable one.

Section 2629-87M. (Held in the name of W. M'Loughlin. Visited 18th October, 1890.)

On the centre of the north boundary of this section some loose gossan may be seen, and there is an outcrop of decomposed serpentine rock that looks something like a lode. I could not ascertain if this had been mistaken for a lode, or if anything else had been found on the section.

North Dundas Company—(Section 2306-87M. Visited 19th October, 1890.)

This section is on the lode described in my former report as Webster and Bennett's. A tunnel has been driven on the course of the lode for 108 feet, running S. 28° E. The lode-gossan is seen on the hill above the tunnel, and again below it; but where the drive has gone in, the lode must either have been thrown to one side of its average course, or else been filled by a large "horse" of country, as the drive has not been successful in finding it. One small crosscut, 15 feet long, was put in at 86 feet from the entrance without touching any lode-matter. It is intended to drive 150 feet, where the adit would be vertically below the outcrop of the lode on the surface, and, if the lode is not then cut, to crosscut the country until it is found. It cannot be far distant, and it is only a question of a short time till it is picked up. The adit is 250 feet below the crown of the hill, and another level 250 feet lower could also be got on the course of the lode, the nature of the country being very favourable for working by adits. It is very unfortunate that this Company should have had difficulty in finding the lode at the point they selected for driving on, as it is one of the typical gossan lodes of the district, and its behaviour in depth will be a great guide as to what to expect in other similar cases. Should it prove, for example, to be entirely oxidised at the level of the present adit it would be well, in Fletcher's and Renison Bell's big lodes, not to drive at a high level at all, but to test them at as near water-level as an adit can be obtained. On the contrary, should lead ores be found in this tunnel, there would be great hope of getting them also in the higher portions of other gossan lodes.

This lode is now said to have been traced through five sections, from 2364-87M on the north, through 2316-87M, 2306-87M, and 2305-87M, to 2304-87M on the south. A large outcrop of iron oxide in the N.W. corner of 2237-87M may also be part of it. Meredith's ironstone lode, running from Section 2470-87M to 2472-87M, and the galena lode running from Section 2523-87M to 2663-87M, are both approximately on the line of this big lode, and may, perhaps, prove to be connected with it. The lodes seem to have a general north-westerly course, more or less parallel to this line, all through the Pieman River portion ot the Dundas field.

Great Nevada—(Sections 2456-87M, 2394-87M, and 2393-87M. Visited 19th October, 1890.)

A strong well-defined outcrop of iron and manganese oxides, with a great deal of quartz, is found running N. 50° E. for about 12 chains through the middle of Section 2394-87M and the north-west corner of 2393-87M. A small portion of it passes through the S.E. corner of 2654-87M.

The ground is rather low-lying on the whole, and the lode will probably have to be worked from a shaft. A tunnel is being put in to test the lode, but has as yet got nothing but thoroughly oxidised ore, and I fear that sinking will have to be done before any payable ore will be met with. The tunnel was only 48 feet in length at the time of my visit, 23 feet being through the lode, which, however, was not yet cut through, and must therefore be even wider than this. The quantity of quartz in the gossan makes me rather doubtful of its probable richness in lead and silver in depth, as quartz does not decompose, and may be expected to be found in depth in equally large proportion as in the outcrop. The lode is a strong one, however, and deserves to be prospected.

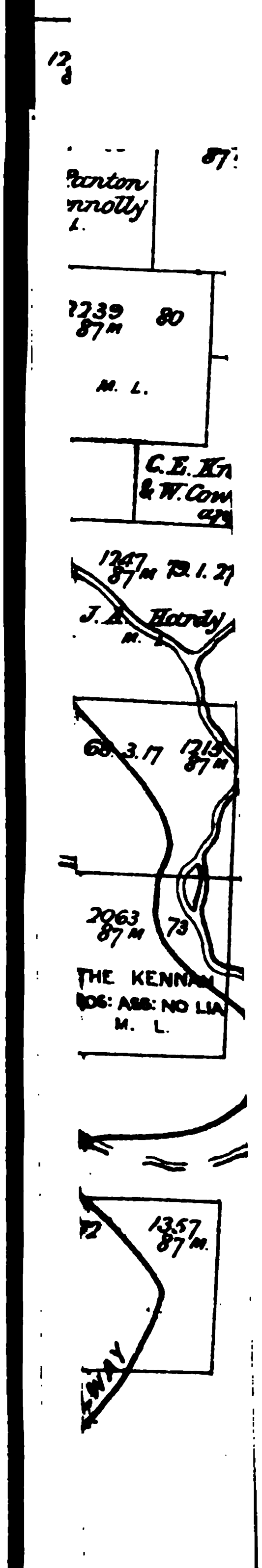
Comet—(Sections 1794-87M and 1796-87M. Visited 20th October, 1890.)

This property has deservedly attracted a large share of public attention, not only on account of its proximity to the rich discovery of galena and cerussite ore in the adjoining Maestri Broken Hill mine, but also from the number of lodes occurring in it, and the facilities for working them by means of adits. The principal workings are on Maestri's lode in the N.E. corner of Section 1796-87M. Beginning at a point about 4½ chains south of the north boundary and one chain west of the east boundary of the section, a tunnel has been driven to the north about 295 feet. Taking the bearings of the tunnel with an ordinary hand compass, I found that the course was N. 50° W. for 216 feet, then N. 17° E. for 79 feet. This brings the end of the tunnel on to the north boundary of Section 1796-87M. The whole of the tunnel is through somewhat clayey oxide of iron and oxide of manganese, except about 22 feet at the inner end, where a soft breccia of angular slate fragments is met with, apparently forming the footwall of the lode. If this point is joined to the point in Maestri's tunnel where the footwall of the lode is met with, the course of the lode is found to be N. 68° W., which I believe is not far from the truth. I am surprised that the Comet and Maestri Broken Hill Companies should be content to remain so much in the dark as to such a very important thing as the true course of their lode. It is quite worth the expense of driving to the boundary in each mine along the footwall. It is not even yet quite certain that both mines are on the same lode, though I think that there can be very little doubt that this is the case. As both adits are in gossan ore from the mouth, it is clear that the lode cannot be less than 4 chains in width, measured on a horizontal plane. If the apparent dip of 35° seen in the footwall in Maestri's tunnel is anything like the true dip of the lode, its thickness must be about 150 feet measured at right angles to the walls.

At 29 feet back from the end of the adit a winze 18 feet deep has been sunk on the lode, and two drives have been made from it, one S. 70° E. 12 feet, and the other N. 12° E. about 14 feet. The last 6 feet of the latter was in the breccia met with in the adit everhead. In sinking the winze, crystals of carbonate of lead soon began to appear, and became more and more plentiful as it went down, till in the bottom really good ore was obtained. In the two drives from the bottom of the winze cerussite crystals occur very freely, together with yellow oxide of lead, locally known as "canary ore." The ore appears to be improving every foot it is sunk upon, and there can be little doubt that even better ore is under foot. Unfortunately, water became troublesome, and the winze could not be sunk deeper. The adit is only a few feet above the level of the creek which traverses the Maestri Broken Hill and Comet properties. In order to strike the lode at a lower level, the manager has determined to drive from another gully in Section 1794-87M. This work was just begun at the time of my visit. The drive will strike the lode only 40 feet below the first adit, or 22 feet below the bottom of the winze. It is believed by the mining manager that the lode will be struck in 360 feet of driving, but this is on the supposition that the course of the lode is about N. 27° W. Should it prove to be, as I incline to believe, N. 68° W., the distance to be driven will be over 500 feet. Under the present circumstances of impossibility of getting pumping engines on to the ground, the policy of driving this adit at so small a depth below the first one is, in my opinion, quite justifiable, especially as it will prospect a good deal of ground and settle the question of the course of the lode. Both this and the Maestri Broken Hill Mine will, however, ere long require to be worked from shafts equipped with good pumping machinery.

The Maestri Broken Hill Company's eastern lode, running about N. 30° W. has been found cropping out, has an ironstone gossan on Section 1794-87M, but nothing has yet been done to test it.

In the south section the ground rises very rapidly into a steep hill 486 feet in height above the level of the creek at the tunnel mouth. The southern boundary of the section lies along the ridge of the hill. The lode in Kozminsky's Section 2297-87M, which I described as Lambie and Davis's in my former Report, has been traced into the Comet ground, several trenches having been dug upon it. In one of these it is seen as a gossan of iron oxide 27 feet wide, and a pit has been sunk upon it about 10 feet without coming to any unoxidised ore or lead minerals. This is about 63 feet higher up the hill than where galena is seen in the lode on Kozminsky's section. The course of the lode appears to be about N. 35° W. Going west-



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ward along the south boundary of 1796-87M another lode is struck, 126 feet lower than the above trench. Here there is a small lode of galena and carbonate of iron, running about N. 30° W., about 2 feet wide. This continues south into Kozminsky's section, and has been bared for about two chains in a surface trench. It is in the valley of a small creek, and could be worked by an adit driven from a point some distance down this. Both these lodes are well worth testing. The upper one has been proved to contain galena over 300 feet above the water-level.

Maestri Broken Hill—(Sections 2356-87M and 2355-87M. Visited 23rd October, 1890).

This mine has at present the best show of ore on the field. The workings are in the S.W. portion of Section 2356-87M, close to the boundary of the Comet ground. About a chain east of this boundary carbonate of lead was found in the large creek passing along the south of the sections. Somewhat soft iron and manganese oxide gossan being found cropping out on the north side of the creek, a tunnel was driven into it in a direction N. 12° E. This almost at once struck rich cerussite and galena ore, which continued to be found in large quantities through the iron and manganese oxides that form the bulk of the lode, for about 120 feet. At 120 feet from the mouth of the drive a band of carbonate of iron striking N. 25° W. was encountered. After passing through this the drive continued in iron and manganese oxides to 206 feet without coming upon any more lead ore. The gossan ore in this portion of the tunnel is arranged in bands running about E. and W. At 206 feet the footwall of the lode was struck, also running east and west, and dipping southerly at an angle of 35°. The country rock from here onwards was brown slate and sandstone, much stained with oxide of iron, and much broken by joints, so as to have a somewhat rubbly character. Occasional crystals of cerussise and pyromorphite and some talc were found through this country. At 447 feet the course of the drive was changed to N. 35° E, so as to go more directly towards the eastern lode seen on surface. About 70 feet had been driven on this new course at the time of my visit. At about 482 feet a vein of manganic ironstone, 1 foot 6 inches wide, was cut through, running N. 55° W. The drive is to be continued to cut No. 2 lode, which ought not now to be far distant.

The ore in the first part of the adit seems to run obliquely across the lode, supposing the course of the latter to be E. and W. as shown by the footwall, or N. 68° W., as calculated from the evidence of this and the Comet mine. At 55 feet from the mouth of the drive a course of ore from 6 to 7 feet wide, carrying galena in bands up to a foot and more in thickness, was passed through, running N. 2° W., and dipping to the west. Another course of excellent galena ore in the mouth of the drive runs obliquely across it also a little to the west of north. Taking the run of these galena bands with that of the carbonate of iron band cut at 120 feet, I think that it will be found that there is a shoot of ore crossing the lode obliquely in a north north-westerly direction. This would agree with the discovery of ore in the Comet winze, which is on the northern side of the lode, whereas Maestri's find is on the southern side. A line running N.N.W. from Maestri's winze would not go far from the Comet winze. Should this theory prove correct, it will be likely that other shoots of ore will in the same way be found to lie obliquely across the main lode mass. A supposition suggests itself that the ore belongs to a north-westerly lode running through the large east-and-west one. This is possible, and will be tested by the new adit in the Comet ground.

A winze has been sunk 25 feet in from the mouth of the adit to a depth of 21 feet, but, as water began to collect, two drives were opened out at 16 feet eastward and westward, on a course N. 75° W. The east drive was 9 feet clear of the winze when I saw it, and the west drive 15 feet. The latter was in splendid cerussite ore, with a good deal of galena and sulphate of lead. The eastern drive was not so rich, though still very good. The lode in the winze and these drives is very rich. The manager estimates that he has obtained 40 tons of first-class galena, 8 tons of good mixed galena and cerussite, and 70 tons of cerussite ore from all the workings. No bulk assay has been made, but numerous small parcels assayed have all given rich returns of silver. It may be seen without assay that the ore is rich in lead, and the assays give every reason to believe that it has a high silver content. The owners of this mine have been fortunate in striking this rich bunch of ore right at the outset of their mining operations. Even though the shoot should prove to be of limited extent, which the find in the Comet renders unlikely, there is good ore enough now in sight to pay for machinery to sink on the lode to a depth of 200 or 300 feet.

Part of the difficulty of ascertaining the course of the Maestri's and Comet lode lies in the fact that the outcrop cannot be traced any distance on surface with any certainty, as the ground soon becomes covered with loose gossan from the outcrop of No. 2 lode, lying higher up the spur. This is a very large outcrop of iron and manganese oxides, covering in places two or three chains in which, running north-westerly across the top of the bridge under which the adit is driven. Pyromorphite has been found in the ironstone in places, but in no quantity; one or two shallow trenches have been dug on it, but nothing further. The extension of the main adit should soon reach this lode. Should it contain payable ore the value of the mine will be immensely enhanced, as it is a very large lode, and there is likely to be a much greater length of it in the sections than of the No. 1 lode. From the difference in their courses these two lodes ought to run into one another.

The manager of the company informed me that there was a third lode known to exist on the leases held, on section 2355-87M, showing siderite, quartz, iron and manganese oxides, blende, pyrites, and a little galena. I had not an opportunity of visiting this lode, which has not yet been prospected to any extent.

Kozminsky's Sections—(2297-87M, 2332-87M, and 2333-87M. Visited 20th October, 1890.)

Nothing was being done on this ground at the time of this visit, and so far as I could learn nothing of consequence had been done on it since my former visit. On this occasion I again looked at the two lodes in the north-east of Section 2297-87M, but found that nothing new had been done. The bulk of the lode-matter in both lodes is carbonate of iron. In the large eastern lode there is not so much galena showing now as formerly, as the prominent pieces have been picked out, and the whole exposure has become discoloured and dirty. The tracing of this lode into the Comet section has shown that its course is about N. 35° W. It is too good to be neglected as it has been, but as a company has been recently floated to acquire these sections, it may be hoped that work will now be vigorously carried on.

The large gossan lode in the north-west corner of Section 2297-87M, which I formerly described as showing crystals of chromate of lead, has been traced south-west through the south-east corner of 1851-87M, and thus appears to have a N.E. and S.W. course.

Talune Company—(Sections 2379-87M and 2380-87M. Visited 20th October, 1890).

At the extreme S.W. corner of Section 2379-87M ironstone gossan is found freely, and a lode most likely exists in the near neighbourhood.

The work on the leases at the time of my visit was confined to driving a tunnel on the north section (2380-87M), not far from the middle of it. This drive is being put in to the eastward from the side of a creek to cut two gossan lodes found higher up on the hillside. One of these, which should be struck in about 50 feet of driving, is a little over three feet wide in the outcrop, and runs about N. 5° W. The second outcrop has only been touched, not even cut through by a trench, so that its course and thickness are still unknown. A third small gossan lode, about two feet wide, was cut almost at the mouth of the drive. About a chain and a half down the creek from the tunnel yet another gossan outcrop has been found. The manager is waiting for drier weather before cutting through this by a trench in the bed of the creek. Nothing can just now be said as to its size or course.

On the hill to the west of the tunnel and across the creek from it, a more promising outcrop than any of the above is found, but has not yet been touched at all. It appears to run N. 5° E, but this is not very certain, as there is a lot of loose gossan lying about, and there is no guarantee that the two outcrops from which the course was taken are parts of the solid lode, or only large loose blocks. An adit from near the creek, about 180 feet long, should cut this lode at a depth of about 100 feet, as the hill rises very steeply. This outcrop is a much larger and more likely one than those that are now being driven upon, but all require prospecting. Nothing but gossan has yet been found on this section, though the number of lodes and their character give good hope that valuable ores will be found in time.

On the southern section, however, 2379-87M, galena has been obtained in low ground by the side of a large creek passing through the holding. The galena is in large cubical pieces, unlike the general character of the galena in other parts of the field, which is rather fine-grained. The lode appears to run about N. 80° E., and consists of 3½ feet of soft earthy manganese and iron oxides, with a vein of quartz from 8 to 12 inches thick, carrying a little iron and copper pyrites. No galena could be seen in the lode when I visited it, though numerous pieces of it were lying all round, so I presume the galena vein must have been covered up by the loose *débris* which has accumulated on the floor of the small cutting that has been made. A small vein running N. 40° E. has been trenched on each side of the creek, and a few pieces of galena appear to have been got from it. Nothing can be done here except in fine weather or by getting machinery to drain the workings. Efforts should be made in the dry weather to trace the lode further away from the creek. The trenching that has been done seems to me to have been off the main line of lode and only on a branch vein.

Adelaide Proprietary—(Section 2302-87M. Visited 21st October, 1890).

This section is remarkable for the great development of ironstone outcrops upon it, there being three large strong lines of them converging to a point about six chains from the north-east corner of the section on the northern boundary. About a chain to the north of this point, in Section 2303-87M, galena and native silver were found in the outcrop of one of the lodes in a creek. The Adelaide Company, having obtained an easement, began to drive on the course of this lode from a point in 2303-87M, about 30 feet north of their own boundary. The course of the drive is about S. 15° W., and it had been driven about 60 feet when I saw it. The outcrop of the lode stands up as a high ridge of ironstone immediately above the tunnel, and may be traced to the top of the steep hill lying south of it, and over into the next valley. It often forms a wall from 12 to 15 feet in height, composed of oxides of iron and manganese, with some quartz: course, N. 15° W. To the west of this lode another one is found on the side of the same hill, also standing out as a bold outcrop, and having a course N. 30° E., which should make it join with the first one about where the tunnel strikes it. This outcrop consists of oxide of iron, often in reniform fibrous shapes, oxide of manganese, and a good deal of quartz. It is very large, quite 30 feet wide in several places. The third lode is seen in the side of the creek, forming steep cliffs 20 to 30 feet high, about four chains S.W. from the tunnel, and running to meet the other two lodes about where they junction. The outcrop of this lode may be seen for quite two chains along the creek. It consists of oxides of iron and manganese, with but little quartz, and is soft in places, and full of small caves. All these lodes have a very promising appearance, especially the first and third. I understand it is intended to crosscut from the main adit to test the second one above mentioned.

The tunnel passed through soft gossan containing some chromate of lead for 36 feet, and then struck bands of carbonate of iron separated by partings of oxide of iron, and mostly carrying a little galena and blende, together with a few quartz bands. A little fairly good galena was occasionally found between the various bands, and some phosphate of lead was also got in the cellular quartz. All the bands appear to be lying about E.N.E. and W.S.W., which is nearly square across the line of lode as seen on surface. This may be due to the junction of one of the other lodes—the third one possibly, as it has about the same course as these bands; or, as in Maestri Broken Hill mine above described, the shoots of ore may lie across the lode at an angle to its course. So far no payable ore had been got in the workings when I visited them, but I have little doubt that it will soon be found, and that this will prove a good mine. It is encouraging to find galena in it so high above the water-level, as it gives hope that it may be worked by adits for a long time before sinking becomes necessary.

Anderson Proprietary—(Section 2303-87M.)

It was on this section that native silver was found in the outcrop of the first lode of the Adelaide Company's. A manager had been appointed, but had only arrived on the ground on the day when I was at the Adelaide, and as he said that nothing had been done on the section, and that he was only going to begin prospecting it, I did not go over it. The Adelaide lode ought to go right through this ground, and if found on the north side of the creek may be easily proved by a drive along its course. The country north of the creek is mostly serpentine.

Sections 2354-87M—(*Dundas Extended*) *and* 2336-87M (*Devonport*) were in much the same case as the last. Managers had just arrived to begin prospecting the claims, so I did not think it worth while to go to them at the present. The original prospectors could not be got hold of to show what had been found, and without a guide it is quite labour lost to hunt for the lodes.

Bonanza—(Section 2317-87M. Visited 21st October, 1890.)

On this section a tunnel is being driven to cut a lode which crops out strongly on the slope of a high hill. This outcrop is mainly of hard clayey and siliceous oxide of iron. The tunnel had been driven 40 feet when I visited the ground, and the lode was expected to be cut very shortly. The country passed through was brown clay with veins and nodules of brown iron ore. This tunnel is about 207 feet below the top of the ridge. About 54 feet lower down another tunnel had been commenced from the side of a small creek. This was driven some 20 feet or so through the same sort of country as the upper one, but had been discontinued until the upper one should have struck the lode and ascertained its position better. There are two ironstone lodes in the south-east portion of the section, and they should join one another near where the tunnel should strike them. I did not care for the appearance of these outcrops much, as they were very clayey and siliceous, instead of being mostly iron and manganese oxides. From this I infer that the lodes in depth will consist principally of clay and quartz, instead of carbonate of iron, which up till now has been the constant concomitant of the galena wherever found throughout both the Zeehan and Dundas Districts.

In a small creek running south through the section, however, very good-looking loose gossan is found in great quantity. This is probably from Kozminsky's chromate of lead lode, which has been traced S.W. from Section 2297-87M through the S.E. corner of 1851-87M, about to the boundary of the Bonanza section. The manager has begun to trench in two or three places to pick up the outcrop of this lode, which ought almost certainly to be soon found.

Very pretty green serpentine is found on the north boundary of this property. It is, unfortunately, much cracked and jointed ; but on being cut into it is very likely that stone fit for lapidaries' purposes may be obtained.

Mount Dundas Company.—(Sections 1708-87M, and 1724-87M. Visited 23rd October, 1890.)

Two very large wide outcrops of iron and manganese gossan are found in Section 1724-87M. A tunnel has been driven, beginning at a point in Section 1708-87M about 600 feet west of the centre of its eastern boundary, on a course of S. 70° E., to prove the ground at a depth of about 250 feet below the crown of the hill on which the more westerly lode crops out. The mouth of the tunnel is in hard black slate, very much contorted. After passing through 322 feet of this, a lode was struck, running about fair across the drive, or N. 20° E., and dipping easterly about 1 in 1, composed of white rubbly cellular quartz, with very little oxide of iron stain. There is an outcrop of quartz on the surface corresponding to this lode, mentioned in my former report on this district. The drive continued to pass through it for 61 feet, when the hanging wall was reached. The country now met with was rather decomposed serpentine, so that this quartz lode appears to be of the "contract lode" character, interposed between slate and serpentine. The serpentine country was cut through till a point 451 feet from the mouth of the tunnel had been reached, and here the footwall of the gossan lode seen on top of the hill was struck. This lode is of very large size in the adit as well as on surface, for it has now been driven across a distance of 179 feet without coming to the hanging-wall. The course of the footwall in the adit is N. 10° to 12° W., and its dip slightly to the east. The lode-stuff varies a good deal. The footwall portion is very flinty, but the bulk of the lode rather soft and clayey. It contains a great deal of cellular and flinty friable quartz, and is more or less stained with oxide of iron, though this is not in any large quantity. On the surface the gossan is very clayey and full of quartz also, but is harder and contains more oxide of iron than in the drive. It is not at all like the iron and manganese gossan found on Maestri's and the Adelaide lodes. From its nature on surface and in the adit I expect that the lode will continue to be very siliceous in depth, and will not contain much carbonate of iron. In the adit the lode-stuff appears to be thoroughly oxidised, and from its porous nature it is probable that it will continue so down to the water-level. If the lode contains lead and silver in any quantity, they will probably be found close to and below this level. The only sign of valuable metals yet found is at from 460 to 476 feet from the tunnel mouth, where a good deal of chromate of lead has been discovered. This shoot of chromate ore appears to be widening as it goes down, being only about 10 feet wide in the roof of the drive, while 20 feet wide in the floor. A winze is being sunk upon it. I look upon this ore as a good indication of better ore being found in depth.

The other gossan lode seen on surface has not yet been tested in depth. It appears to me to be of a rather more promising nature than the first one, the gossan being less siliceous and containing more oxide of manganese. I confess, however, that this preference of the iron and manganese gossan to the clayey and siliceous lodestone may be only a prejudice, as the knowledge yet gained of the anatomy of the Mount Dundas lodes is much too limited to allow any conclusion, favourable or unfavourable, to be safely drawn on the point. It may prove that quartz is a better gangue for bearing lead and silver than the carbonate of iron. (These remarks will also apply to what has been said of the Great Nevada and Bonanza lodes.)

In a lode of the great size of that cut in the adit, it is most probable that the ore exists in patches and shoots, and further prospecting may yet find a Bonanza in it. The discovery of the chromate shoot shows that there is lead ore in the lode, and gives hope of better ores being found below. The further development of this mine will be watched with great interest by all who have anything to do with the field.

Maestri Silver Prospecting and Mining Association—(Section 2549-87M. Visited 24th October, 1890.)

Near the N.W. corner of the section some work has been done close beside a creek which here falls about 60 feet very rapidly in a succession of small waterfalls; consequently an adit could be driven under very favourable circumstances. In this creek several veins of solid white quartz up to three feet thick are seen. These, however, do not appear to be regular reefs, but rather what miners call "country quartz"—that is to say, irregular veins and bunches of no considerable extent. Near one of these veins a few crystals of galena and blende have been found in the joints and cleavage planes of the schist country rock, but as far as I could see there was no sign of the existence of a lode. A dyke of greenstone about 8 feet wide is found near here, and it is likely that the formation of the quartz bunches and the deposition of the minerals were due to its intrusion. The rock in which the galena was found is undoubtedly the country rock, not lode stuff at all. The occurrence of minerals in fractures in country rock is very common, and no significance can be attached to it.

About seven chains from the south boundary, and one chain from the western one, two trenches have been cut on a steep hillside. Some rather indefinite veins of quartz and gossan have been found in them. The quartz and a silicified schist associated with it carry iron pyrites and a little siderite. The veins are small and do not give much promise of permanence. Some assays are said to have been obtained from them of about 4½ ounces of silver to the ton however, and as they may come together and make it into a better lode in depth, some more prospecting might well be done on them. I do not, however, think that present appearances warrant the driving of a tunnel 300 feet long as is proposed. The outcrops might, with advantage, be cut into a little more deeply on surface so as better to expose the lodes. I have very little hope of the success of any operations upon them.

General Remarks.

As far as I could learn there was very little more to see on the field on the Sections not visited than quite undeveloped outcrops of gossan; mining work is only beginning on many of them. The character of the Dundas field can be fairly gathered from the description of the above selection of the Sections. I have no doubt at all as to its ultimate success; that is as assured as any mining district's future can be. If worked in a legitimate manner, and not for speculative purposes, its development should be rapid. The field has several advantages to compensate for the difficulties in opening it up; it has good timber, good water, and great facilities for drainage by adits. Where ordinary tramways could not be constructed there are few places where a short wire rope tramway would not connect the mines with practicable routes for them. Aerial tramways are not in common use in this Colony as yet, but I expect that they will be found very useful at Dundas. I do not like to speak positively as to the possibilities of getting water-power on the field, as I saw it when the streams were all full, after a longish wet season, but I should think that it is quite possible to get a supply of water for power from some of the larger creeks without much difficulty. In the deep valleys in which they lie it is very improbable that there are not many places where reservoirs might be constructed at a low cost. Should water-power be available electric energy might be utilised in a great many ways with great advantage. The use of electricity in modern mining is increasing very rapidly, especially in the United States of America. There is one source of energy that might be utilised for the South Dundas field at any rate, in the Big Henty River. It is not too far to bring electric power from this, and the water supply is a never-failing one. For the northern field there is plenty of power to be utilised in the numerous large affluents of the Pieman River.

In concluding my report of the state of the Dundas field, I have to acknowledge my gratitude to the various gentlemen who took so much trouble to show me over the properties, for the courtesy and kindness which they have showed to me. I am especially indebted to Mr. Charles Robb, who gave up four days of his time to guide me from Mr. Meredith's camp, near the Pieman River, to the South Dundas field. Without his assistance I should not have been able to find my way through the northern field.

COAL MEASURES AT THE HENTY RIVER.

On my return to Strahan from Dundas and Zeehan I made a discovery which may have a great influence on the future of these fields. Messrs. Jones and Bethune having applied for a lease of some ground for limestone, to be used as flux, wished me to look at it, especially as the limestone was full of fossils. The limestone was found in a creek running into the Big Henty River, on the north side, a short distance above the railway bridge. On making an examination I found that there was a considerable extent of ground along the railway line, just north of the bridge, occupied by a coarse white grit or sandstone. I was not able to define the boundaries of this formation, but it must be over two or three miles long and quite a mile in width. The creek in which the limestone was found has cut through this sandstone, affording a section of the strata about 200 feet deep. The stream falls very rapidly, there being about five small waterfalls from 8 to 30 feet in height in the space of about half a mile. The strata appear to lie almost horizontal, and to be very little disturbed. Below the gritty sandstone I found beds of fossiliferous sandstone containing species of *Spirifera*, *Productus*, and *Fenestella*. Going down the creek these sandstone beds were found to alternate with beds of mudstone and impure limestone, containing the same sort of fossils. The limestone is as a rule much too impure to be used as a flux; it contains a great many pebbles which would increase the per-centage of silica in it to far too high an amount. Some of it would probably burn to a fair hydraulic lime or cement, as it appears to be somewhat argillaceous. Below the lowest limestone beds come others of black shale or slate, with but few fossils; and beneath these, again, at a height of only about eighteen feet above the level of the Henty River at the bridge, I found black shale very full of impressions of ferns characteristic of our lower coal measures, belonging to the genera *Glossopteris*, *Gangamopteris*, and *Nœggerathiopsis*. These were the lowest beds seen, for immediately below them down the creek I found clays containing leaves of a Tertiary type, doubtless belonging to the series of Tertiary leaf-beds surrounding Macquarie Harbour. These must rest against an escarpment of the coal-measure rocks. The discovery of the *Glossopteris* shales under the limestones is the point of importance in this section, as the same succession occurs in the Mersey and Don coal-field; and there the coal seams are closely associated with similar *Glossopteris* shales. It is not unlikely that there may be coal at the Henty also underneath them. The probability of this being the case is quite sufficient to warrant testing the measures with one or more diamond drill bore-holes. The first one of these would be well located just where the shales were found, the place being easy of access, and well supplied with wood and water. Should coal be proved to exist, its proximity to the railway from Strahan to Mount Zeehan would render even a small seam valuable. The coal seams, if any, will probably be found to extend under all the gritty sandstone seen on surface; and there is enough of this visible to show that there would be a considerable field. The country has not yet been explored to determine the probable size of this; but the finding of carboniferous fossils at Bell's and Hall's, at Mount Zeehan, makes it probable that the area is greater than might be suspected. We cannot tell, either, that the coal measures do not extend under the Macquarie Harbour leaf-beds, which occupy the flat ground between the Henty River and Strahan. The benefit to be got from the discovery of coal in this locality is so great that a much more remote chance of finding it would be worth trying. There may be no coal at all, or only thin worthless seams; but, on the the other hand, there is a good chance of finding a payable seam. I hope to hear of the ground being soon tested.

Near the Henty Ferry there is a bed of clay lying underneath the drifted sand-dunes. This appears to the eye to be of good quality, and may be very useful to make into bricks for the furnaces at Strahan and Mount Zeehan, and I therefore draw attention to it.

I have the honor to be,
Sir,
Your obedient Servant,

A. MONTGOMERY, *M.A.*, *Geological Surveyor.*

To the Secretary of Mines, Hobart.

REPORT ON THE GEOLOGICAL STRUCTURE OF THE BEACONSFIELD GOLDFIELD.

Geological Surveyor's Office,
Launceston, 10*th July*, 1891.

SIR,

I HAVE the honor to report to you the results of my geological examination of the Beaconsfield District.

Maps.—In order to illustrate and render the report more intelligible, there are sent herewith the following maps:—Plan No. 1, a plan of the Beaconsfield Goldfield, showing the position of the principal mine workings and the strata in which they occur; Plan No. 2, a plan of the Tasmania mine and enclosing strata, the latter being shown on the horizontal plane of the main adit; Plan No. 3, a similar plan of the underground workings of the Little Wonder, Moonlight, and Amalgamated West Tasmania mines, and a section across the Cabbage-tree Hill, showing the order of superposition of the strata. These maps are compiled from the official maps of the sections held under lease and otherwise in the district, the plans of the underground workings of the mines furnished by the owners annually to the Inspector of Mines, and my own surveys. Mr. G. T. Eddie's valuable maps of the Tasmania mine were also used at times, and I have to acknowledge Mr. Eddie's great courtesy in allowing me the use of his original plan.

My first and principal examination of the district was in January and February, 1890, though several visits were made to it subsequently, hence the state of the mine workings shown on the maps is generally as seen at that time, later workings not having been in all cases plotted. The extensions of workings made since the beginning of 1890 have not, however, to my knowledge resulted in giving any further information as to the geological structure of the ground.

Previous Reports.—Two reports on this district have been previously made to the Government—the first by the late Mr. Charles Gould in 1866, entitled "Geological Surveyor's Report of the country near Ilfracombe, in the West Tamar District"; and the second in 1883 by Mr. G. Thureau, F.G.S., on the "Beaconsfield and Salisbury Mining District." Mr. Gould's excellent report deals with the general geology of the country, and more particularly with the large deposits of iron ore near Ilfracombe and at Anderson's Creek. A full narrative of the attempt to work these ores for iron is given by Mr. T. C. Just in the "Tasmanian Official Record, 1891." Analyses of the ore, the iron manufactured from it, and the slags from the smelting are given by Mr. R. M. Johnston in his "Geology of Tasmania," on page 28; and another analysis made for Mr. Gould by Mr. G. Foord, of Melbourne, is given in the "Monthly Notices of Papers and Proceedings of the Royal Society of Tasmania, 1866," page 84. To the full information as to these interesting iron-stone deposits given in these papers, I have nothing to add further than the remark that the increasing use of chromium steel bids fair to render what was formerly the defect in the iron made from them, namely, its percentage of chromium, its principal merit at some future, but perhaps not distant date.

As regards the present mining district of Beaconsfield, gold does not appear to have been found in it till long after Mr. Gould's survey, and consequently his report mentions only the general features of the country, and does not go into further detail than giving the succession of the strata seen in the Middle Arm Creek (now called Blyth's Creek). As a general report it is most excellent, and should be consulted before the later and more detailed and restricted examinations by Mr. Thureau and myself are taken up by anyone desirous of studying the district.

Mr. Thureau's report deals more particularly with the portion of the country forming the Beaconsfield and Salisbury goldfields, and gives valuable information about the structure of the district as revealed at the time, and more especially as to the alluvial workings on the surface, and in the "deep lead" which runs along the eastern base of the Cabbage-tree Hill. As giving a description of the mines in their earlier stages of the principal features of the reefs, and of the Salisbury portion of the field which the present report does not deal with, it also should be read before this one is taken up.

The report which I now have the honour to submit to you is the result of a still more detailed examination of the Beaconsfield Goldfield, with the following objects in view :—(1.) The obtaining of more definite knowledge as to the relations of the various beds of country rock to each other and to the auriferous reefs, and their influence on the gold value of the latter; (2) The determination as far as possible of the position and effect on the reefs and the country of the various crosscourses or faults that disturb them; (3) The collection of further information as to the "deep-lead" or buried river channel running along the eastern base of the Cabbage-tree Hill; and (4) The noting in general of all facts connected with the geological structure of the district likely to be of interest and value either practically or scientifically.

General Topography and Geology.—Without going over the ground already traversed by the reports of Messrs. Gould and Thureau unnecessarily, it seems advisable to begin by recapitulating the principal facts as to the general topography and geology of the goldfield. The main feature in both respects is the low range known as the Cabbage-tree Hill, running N.W. and S.E. about two miles inland from the Middle Arm of the River Tamar, and approximately parallel to it. The hill is a little over two miles in length, and averages from 350 to 420 feet in height above sea level. The same range continues on to the south-east under the name of the Blue Tier, this and the Cabbage-tree Hill having once formed a continuous range, which has been cut into two parts by erosion of the deep gorge of Blyth's Creek, which now separates them. At its north-western end the Cabbage-tree Hill is separated by the Brandy Creek from rolling country, which forms the watershed between the latter and Anderson's Creek. From the Middle Arm the ground rises pretty evenly with a gentle slope to the base of the hill where the Town of Beaconsfield is situated. As the main street of the town is only about 100 feet above sea level, the slope from it seaward is so slight that the country may be called a plain. South of the Cabbage-tree Hill about two miles lies another hill known as the Blue Peaked Hill, and between them the ground is flat and somewhat marshy in parts. This flat extends up the Flowery Gully, an eastern tributary of Blyth's Creek, to a point about due east from the Blue Peaked Hill.

Several geological formations are represented in the district. The hills mentioned are all composed of hard metamorphic sandstones, slates, grits, and conglomerates, of probably Lower Silurian age. About a mile west of the northern end of the Cabbage-tree Hill old volcanic rocks are found, forming a large patch of serpentine country. The stratified Lower Silurian rocks are generally inclined at rather high angles of dip, and form some synclinal and anticlinal folds. Their general strike is about N.W. and S.E., corresponding with the long axes of the hills, the existence of the latter as hills being clearly due to the greater resistance offered to erosion by the hard sandstones and grits of which they are composed as compared with the softer slates skirting them. The distance to which the Silurian formation extends towards the Tamar cannot be accurately estimated as yet, as the surface is much covered with later deposits of gravels and clays. From the West Arm to the Middle Arm the shore is found to consist of sandstones, mudstones, and limestones of Carboniferous age, except at Beauty Point, where Tertiary basalts are found. The Carboniferous rocks cannot extend more than a short distance inland before the Silurian formation crops up from under them, but the junction of the two is obscured by more recent superficial deposits. These are of various ages, ranging from the early Tertiary to the Recent period, the gravels of the "deep lead" being probably of the former age, while the shallower surface gravels are more recent. The deep alluvial ground of Flowery Gully and the flat between the Cabbage-tree and Blue Peaked Hills may contain deposits belonging to the older Tertiaries as well as the recent ones visible at surface, and may perhaps in places also cover the Carboniferous formation.

The general history of the locality may be sketched thus :—Sediments of gravel, sand, mud, and calcareous matter laid down on the floor of a sea in the Lower Silurian period were hardened into grits, sandstones, slates, and limestones, crumpled into highly inclined folds, elevated into mountain ranges, and greatly worn away by sub-aerial and marine erosion in the immense interval of time intervening between their deposition and that of the later Carboniferous beds. The latter were deposited as shell-banks and beds of sand and mud at a much later date on the upturned edges of the older strata at a time when the surface of the land was relatively lower than at present, and the sea came well up to the flanks of the Cabbage-tree Hill, which at that time must have been an island or peninsula, as the Carboniferous beds are found now nearly surrounding it. No great contortion of the strata has taken place since these beds were laid down, as they still lie almost horizontal, and show no signs of metamorphism or strain due to pressure. However, between the date of their deposition and that of the early Tertiary deposits, elevation of the land must have taken place to a height probably quite 300 feet above the present level, as the next evidence of geological work which is met with in the district is the formation of the channel of the "deep lead." This is an old river channel, and the water that scooped it out must have run downhill to the sea; hence, as the bottom of the lead is proved by the Ophir Company's borings to be now 270 feet below sea level, it must at one time have been more than that distance vertically higher than its present position. This elevation of the land subsequently to the laying down of the Carboniferous beds very probably took place during the Mesozoic period, when the immense outflows of diabase greenstone, which are so prominent a geological feature, throughout the whole colony, were being emitted. This greenstone occurs very abundantly on both sides of the River Tamar from Middle Island up to Launceston. The channel of the lead was doubtless

eroded deeper and deeper as long as the movement of elevation proceeded, but after a time, the ground remaining stationary or beginning to subside, it began to become filled up with deposits of gravel. A movement of subsidence now appears to have set in, for the old channel became more and more filled up. At one stage it appears to have been a swampy estuary or valley, as there is in it a deposit of black mud mixed with fragments of timber, leaves, and other vegetable remains. It is from this portion of the alluvial beds that specimens were obtained of fossil fruits (see Johnston's Geology of Tasmania, page 278), which enable the age of the lead to be certainly referred to the Older Tertiary (Palæogene) epoch. This lead is therefore contemporaneous with some of the oldest deep leads of Victoria and New South Wales. As subsidence went on the old channel at last became entirely filled up. There is reason to believe that the subsidence did not cease when the ground had reached its present level, but continued until the sea reached a point on the flank of the Cabbage-tree Hill at least 250 feet above the present tide-mark. The evidence for this is that we find at 250 feet above sea-level on the Moonlight Company's section (No. 349) heavy rounded water-worn stones and coarse gravel, and at the same height on the eastern slope of the range there are heavy deposits of similar gravel in Eastman and King's and Bruen's old workings. The deposits in these consist of boulders, heavy gravel, and clay, all more or less horizontally bedded or dipping slightly seaward. Their being found on both sides of the hill up to a fairly constant level creates a great likelihood that they are remnants of a large body of gravel which once surrounded the hill up to that level, but has since been almost entirely removed by erosion. The level of the highest occurrences of heavy gravel, therefore, probably represents the sea level at the end of the last period of subsidence. From the evidence obtainable in other parts of the colony it is known that the extensive outflows of basalt which cover a large area in the northern districts, forming the best farming land, took place towards the end of the Palæogene or Older Tertiary period, and it is possible that the disturbance caused by these resulted in elevating the land again to about its present level. During the progress of this elevation (a slow movement in all probability) the deposits of gravel which had accumulated round the Cabbage-tree Hill have been swept away nearly down to the bed-rock, leaving only the remnants above mentioned and occasional gravel mounds on the plain to attest their former existence. There is some of the basalt just mentioned at Beauty Point and at Point Effingham, in the immediate vicinity of the Beaconsfield District, and a little further away, at Lefroy and Back Creek, it is again found, and this time covering auriferous deep leads. There is a possibility that the Beaconsfield deep lead may also run under the basalt towards Ilfracombe.

From a consideration of this history the obscure and patchy character of the alluvial deposits will be understood, and it will be seen that the configuration of the present surface can afford little, if any, indication of where the deep ground lies.

Deep Lead.—While this history is fresh in mind, it is well to finish our consideration of the "Deep Lead." It has long been known that along the eastern base of the Cabbage-tree Hill there exists deep alluvial ground, this being proved by numerous shafts and prospect holes. The main street of Beaconsfield (Weld-street) is almost fairly upon the centre of this ground. The principal workings have long since been abandoned, and it is hard now to fix the sites of even some of the old shafts with any certainty. Such as I could determine are shown on Plans Nos. 1 and 2. All these old workings were either on the "high reef" or sloping edge of the lead, or on false bottoms. The lowest workings were 112 feet from the surface on a false bottom of black ligneous clay. None of the workings have yet reached the "gutter" or bottom of the old river channel. I have not been able to obtain much really reliable information about the old mine workings, the accounts given by various presumably well-informed persons being very conflicting. It would seem, however, that the workings on the "high reef," that is, on the Silurian bed-rock forming the sloping sides of the channel, were fairly payable, and that there was also a good deal of gold on the black false bottom. No good section of the lead has yet been obtained. The diamond drill bores recently executed by the Ophir Company do not give a satisfactory section, as the greater part of the boring was done without bringing up any solid core, and consequently the exact nature of the strata passed through is somewhat doubtful. Two bores were put down, marked D and E on Plan No. 1, and Ophir bores No. 1 and 2 on Plan No. 2, to a depth of 375 feet and 286 feet respectively. The following section of the deeper bore was given by Mr. Bowen, the Director of the Company, who superintended the boring:—

"First bore, 375 feet, passed through from surface sandy clay with gravel to 40 feet, then pug 200 feet, then gravel containing gold at two ounces to load, then boulders to 300 feet intermixed with clay, then black clay, 50 feet, then decomposed timber, &c., then wash to bottom." Elsewhere in his report Mr. Bowen says that at the bottom of this bore there were 9 feet of wash with gold at the rate of 4 ounces to the load. The second bore bottomed on limestone at 286 feet, and had "about 12 feet wash, giving returns at 2 ounces to load." If these results are reliable the richness of the lead would be phenomenal.

The Ophir shaft, which was sunk to a depth of 300 feet in the alluvial and bottomed on sandstone, ought to have given an excellent section of the lead; but I have not been able to obtain any more definite account of it than that it passed through a succession of beds of gravel, sand, and clay, occasionally containing a little gold. The surface of the sandstone bottom sloped to the north-east, showing the shaft to be on the south-western side of the gutter. Orchard's shaft (see Plans 1 and 2) struck limestone bottom at 192 feet, dipping south-westerly, and between it and the Ophir shaft the bores E and D strike bottom at 286 feet and 375 feet; hence the "gutter" is evidently close to bore D. Owing to the swelling nature of the ground the Ophir shaft has become twisted and more or less useless, and no work has been done on the lead from it. The policy of sinking a shaft in the solid rock to a depth well below the lead, and then driving out under it being adopted now by the Ballarat Company, is a much safer one than that of attempting to sink in the drift itself, and much more conducive to the economical working of the gutter.

To the east of the Tasmania mine workings the lead evidently passes not very far from the Lefroy shaft. The No. 4 and No. 5 levels of the Florence Nightingale mine were driven out into it, encountering drift and gravel in the face, at depths of 270 and 330 feet. The Lefroy shaft itself seems to have been in alluvial material for about 70 feet, and then to have been sunk in soft clayey slate. The East Tasmania bore and the workings of the Dally's United mine prove that the alluvial channel keeps close in to the foot of the hill going south-east from the Lefroy shaft, and it most probably hugs the foot of the hill right to the Blyth's Creek in this direction. Alluvial material was passed through in the first 300 feet of the

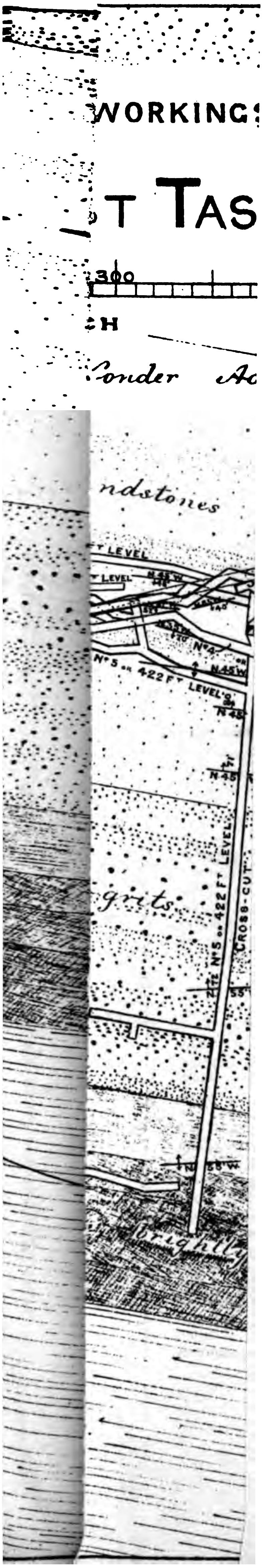
Tasmania main adit, and for 412 feet in the mouth of the lower Cosmopolitan adit. Past this point I have not been able to trace it as yet to the south-east; but from the outcrops of solid bed-rock it almost certainly must pass under Blyth's Creek near the bridge on the road from Beaconsfield to Launceston. The northerly extension of the lead from the Ophir bores probably runs N.W. and then N.N.W. out under Brandy Creek. Mr. Thureau in his report gives a sketch map showing two leads coming together from the N.W. and S.E. at the Ophir ground, and then breaking out north-easterly towards the sea. There is deep ground in this latter direction, for J. T. Allen bored some 170 feet at a spot approximately marked on Plan No. 1, and was forced to stop without reaching the bed-rock by coming upon a bed of hard conglomerate boulders. The drives from the East Tasmania and Dally's United shafts, the shaft of the old Duke of Edinburgh mine, and the occurrence of solid bed-rock near the intersection of Weld and Crowther streets, together with several wells and shallow borings put down from time to time by various persons, have, however, pretty conclusively proved that there is no outlet for the lead in this direction, and Allen's bore must be in a different lead. It is probably connected with a run of deep ground found to the eastward of the Beaconsfield Public School, and perhaps this second lead may prove to be a branch of the Ophir one.

The further tracing of the lead will probably be left until such time as the works now in progress will have demonstrated the payableness or otherwise of the part about to be worked. Should the result be favourable the extensions of the lead will be of very great importance. The tracing will be rather a slow and expensive matter, as it will require series of lines of borings across the most probable courses of the old channel.

As to the prospects of the gutter proving payable there is much difference of opinion. There is no doubt that the upper portions of the gravels have been auriferous, but a very general opinion appears to prevail locally that under the false bottom on which the deepest workings are situated there will be no payable gold. The grounds for this notion are difficult to imagine. Rightly or wrongly a belief is very prevalent in the district that the good results got from the recent Ophir bores, and from a previous bore called Orchard's bore on Plan No. 2, were not genuine,—in fact, that the bores were "salted." No good reason is ever given for this belief, which is a most unfortunate one for the district, as a mere suspicion of such a thing acts as an absolute bar to investment of capital, and I quite fail to see any reason why gold should not have been genuinely got from the bores. On the contrary, there are good *a priori* reasons for thinking that the lead ought to be richly auriferous.

The channel has been eroded through the auriferous Silurian rocks. We know that the reefs existed before this erosion, for the Tasmania reef, as above stated, has been found to be cut through by the lead in the most easterly workings. It is clear, then, that a large piece of this reef has been cut out and sluiced in the old channel. But all the time that the latter was being eroded the surface of the Cabbage-tree Hill and its numerous contained auriferous veins was being also worn down, and in natural course the contained gold would find its way into the channel. The fact that the gravels filling the lead are all derived from the Silurian grits and sandstones disposes of any objection that perhaps at the time of formation of the channel the adjacent hill slopes were covered with coatings of more recent rocks, of the Carboniferous period for example. If these had existed they would have contributed their share of the gravels. Now, all the time that the river channel was being cut down, which must have been considerable, it acted as a sluice to concentrate the gold brought down from the adjacent hillsides. The later gravels derived from these same hillsides have been proved to be auriferous, then why not also the earlier ones? Further, it may be observed that while the later gravels were deposited during a period of subsidence when the channel was slowly filling up, and therefore the gravel once deposited was but little disturbed afterwards, in the earlier stage the gravel never could accumulate, but was swept out by the force of the stream which was cutting its way down through the bed-rock. While this action must doubtless result in carrying a great deal of gold down the river, at the same time it affords much greater opportunity of concentrating the gold into the bottom of the gutter than in the subsequent stages when the latter was filling up. In my opinion, therefore, there is every reason to expect that the bottom of the lead will be rich. Like all such leads it is to be expected to vary very much in quality, and no surprise and alarm should be felt if the first truck-load of wash extracted from it does not realise expectations. Patient work may be required before rich deposits are found. This is no news to anyone knowing anything of deep leads, but may be useful to other investors.

Cabbage-tree Hill.—Turning our attention now to the rocks of the Silurian system, we find that it is in those of the Cabbage-tree Hill that the most important gold discoveries have been made. Auriferous reefs have also been found at the Blue Tier, but the mines here have practically been at a standstill for a long time past. Not having examined this portion of the field, this Report will not refer to it further. The ridge of the Cabbage-tree Hill is composed of coarse-grained grits or fine quartz conglomerates, alternating with beds of hard metamorphic sandstone. On either side of the hill softer slates and sandstones are found. The general strike of the formation may be taken as that of the ridge, N.W. and S.E., though, as shown by the Plan No. 1, this is not uniformly preserved. Though a certain amount of folding of the strata can be seen in the crown of the ridge (see section) the general dip is to the north-east, the average angle of dip lying between 45° and 75°. The lowest beds of the series are therefore those seen on the western side of the Cabbage-tree Hill. The plans and section show the succession of the strata. The bluish slate, which is the lowest rock seen, is found in the Britannia shaft and in some old shafts to the north-west of the Little Wonder workings. In the extreme end of the deep crosscut at 422 feet level from the Moonlight shaft a band of fine-grained black sandstone is encountered, which must lie between the slate and the next band seen on the section, namely, a very peculiar jointed, shining, graphite-like slate. This is made up of small fragments polished brightly and striated on every face, showing the results of extreme pressure. The black colour of this rock is due to carbonaceous matter. It is encountered again in the drive south-west from the Moonlight No. 3 or most westerly shaft, and in the mouth of the Little Wonder adit, though here somewhat altered by loss of its black colouring, also in the old Garfield shaft. Upon it lies a bed of soft clayey tenacious slate, locally known as "pug." This is found with the graphite-like slate in the mines just mentioned. The next beds in the ascending series are shown by the workings of the Little Wonder, Moonlight, Amalgamated West Tasmania, and Tasmania mines to be a succession of layers of metamorphic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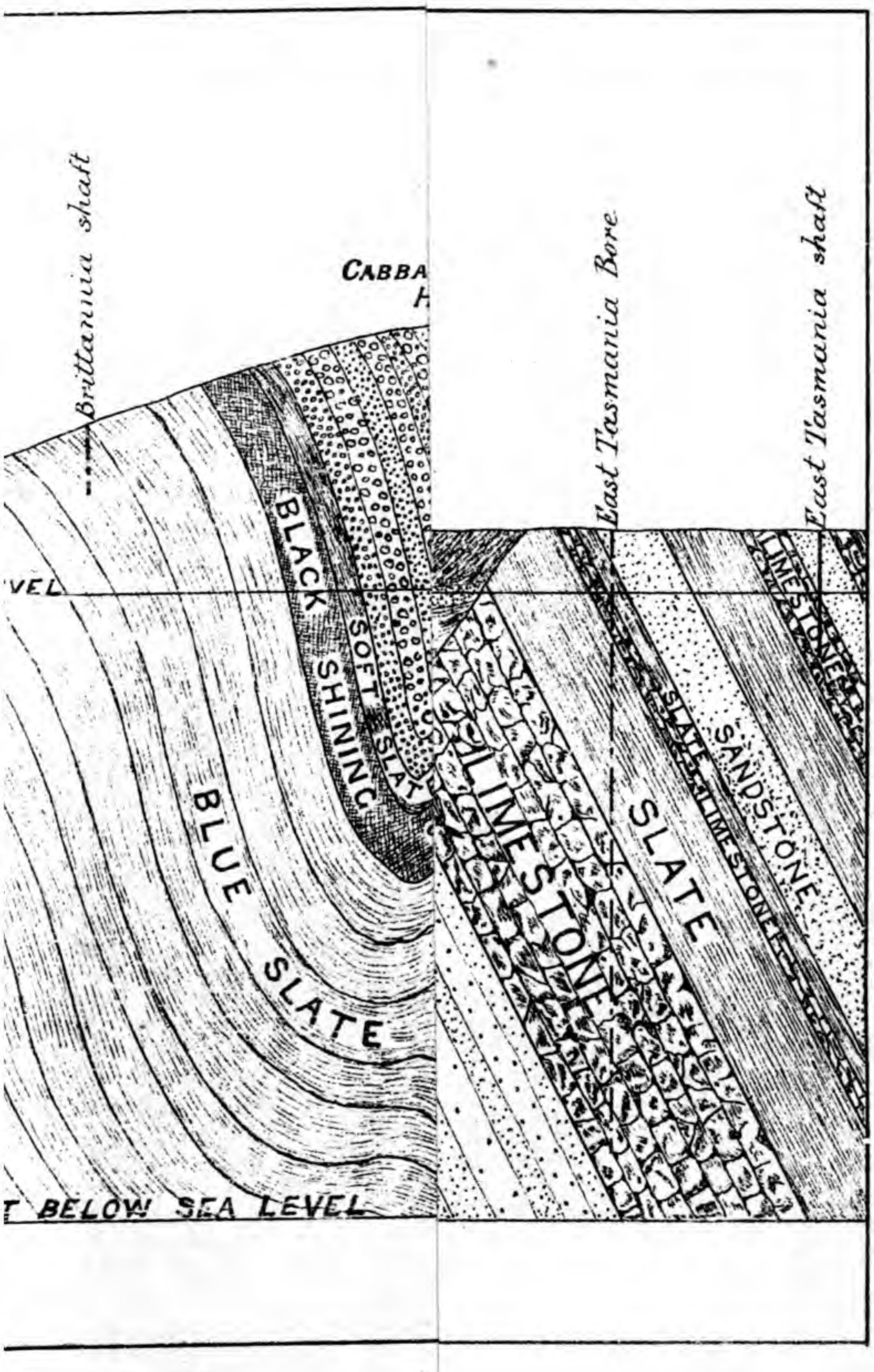
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East Tasmania Bore
East Tasmania shaft
BLACK SOFT SHINING SLAT
BLUE SLATE
LIMESTONE
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LIMESTONE
VEL
T BELOW SEA LEVEL

sandstones, grits, and conglomerates. There appears to be, as shown on Plan No. 3, a layer or series of layers of black grits overlaid by another series of similar beds of much lighter colour. The lower black grits are highly charged with carbonaceous matter. In a new crosscut now being driven east from the Moonlight shaft, and in the No. 5 level of the Tasmania Mine, west of the second crosscourse, there is a great abundance of a substance, to which I can give no better name than a soft coal, mixed up with the gravel and sand forming the grits and sandstones, and often thus preventing the material from cementing together into the usual hard stone, and lying between the layers and in the joints of the rock. Though all apparently containing a large percentage of earthy matter, pieces can be readily got which will take fire in the flame of a candle, and burn like charcoal, without flame, for some time after being withdrawn from it. Heated in a closed tube a little tarry matter is given off, but so little as to show that the substance must be almost all carbon. The purest pieces are bright and shining, very soft and friable, and burn to a white ash. From the way in which the carbonaceous substance is not only interspersed through the substance of the rock, but also through joints and fissures in it, I am in some doubt as to its origin, but think that most probably there was a great deal of organic matter among the sands and gravels when originally deposited as sediments, and that, during the processes of metamorphism to which the rock has been subjected, part of this has been volatilised as oil or tar through the joints in the rock, and afterwards been completely carbonised, while part remained as carbon where originally deposited in the sediments.

Overlying the beds of grit and conglomerate comes a large band of very hard black crystalline sandstone, seen very well between the two main cross-courses in the Tasmania mine. In parts this contains layers of coarser grit, and sometimes the grain is so coarse that the rock would be rather called a grit than a sandstone ; still, on the whole, sandstone predominates in this portion of the strata. The differences in lithological character exhibited by different parts of the same bed of sediment often render it difficult to be sure of their identity. On the plan I have shown by similar marking the beds which appear to belong to the same horizon in the series, even though they do not appear to be altogether the same in character at different points. This black sandstone, for example, is more a grit towards Blyth's Creek, and also towards Brandy Creek. On the eastern side of the main cross-course in the Tasmania mine it is met with close to the fault in No. 6 level, and the diamond drill bore of the Phœnix Company went into it after passing through the reef. The lower position of this black sandstone with regard to the strata met with in the main body of the Tasmania mine workings is therefore well assured. The Phœnix diamond drill bore, the workings of the Tasmania mine, and the long adits of the Olive Branch, Bonanza, Leviathan, and Cosmopolitan Companies, give numerous excellent sections of the strata lying above the black sandstone. Three bands may be distinguished—the lowest, a white sandstone often containing numerous but very imperfect fossil casts ; next, a dark bluish sandstone which forms a well marked band in the Phœnix bore, but owing to variation in colour is not always easily recognised in the other sections ; and above this a long series of small beds of light bluish, light grey, and yellowish sandstones, with thin partings of mudstone or slate. The higher (more easterly) beds become more and more slaty in character, and thin beds of impure limestone make their appearance. These limestone beds, however, do not as yet appear to be continuous over long distances, the limestones lately struck in the Ballarat shaft, at and below 250 feet, not apparently having extended into the Tasmania mine, but been changed to mudstone and sandstone. The strata lying between the eastern workings of the Tasmania mine and the next section, that seen in the East Tasmania diamond drill bore, may be seen in places on surface in the alluvial workings west of the Ophir shaft, and are still sandstones and slates. The workings of the East Tasmania bore, the Dally's United mine, and the East Tasmania mine nearly complete the section visible. The most notable feature in this portion is the thick band of limestone met with for over 500 feet in the bottom of the bore. This is again struck in the southern drive from Dally's United shaft, and probably is identical with the large band of limestone worked in Dally's quarry, on Blyth's Creek. Beds of slate, impure limestone, slate, and sandstone succeed the main limestone mass. The next known rock in the series is a bed of hard blue limestone met with in the bottom of the East Tasmania shaft. On this again lies an arenaceous, often calcareous slate, with bands of soft schist. From this point eastward the exact succession of the strata has not been revealed. A shaft to the north-west of the Police Station shows blue slate, and the Middle Arm Creek shows a few exposures of schist, sandstone, and limestone, from which we may conclude that the higher beds are a succession of these rocks. The whole formation is evidently of immense thickness, the section now given showing over 3000 feet of rock, all on one side of an anticlinal axis running somewhere to the west of the Cabbage-tree Hill. The beds seen in the Middle Arm Creek render it probable that the thickness is very much greater still.

A very hurried visit to the Blue Peaked Hill showed it to be composed of sandstones similar to those of the Cabbage-tree Hill, and it seems possible that the strata there may be those of the latter repeating themselves on the other side of an anticlinal axis. Against this supposition, however, is the occurrence of a large quantity of solid blue crystalline limestone at the head of the Flowery Gully, which has the same strike and the same north-easterly dip as the strata of the Cabbage-tree Hill. The exact similarity of the stone to that in Dally's quarry and the East Tasmania bore leads one to suspect some connection between these beds, but as yet none has been demonstrated. I hope to have an opportunity of running a section over the Blue Peaked Hill from Beaconsfield to the Flowery Gully caves in order to elucidate this matter. It is of practical importance, as a recurrence of the auriferous strata of the Cabbage-tree Hill would probably be accompanied with similar quartz veins.

Flexures of the Strata.—Though, on the whole, the strata seen in the section across the Beaconsfield field are dipping to the north east, there are several flexures in them which in places reverse the usual dip. As seen in the section these flexures lie under the crown of the ridge of the Cabbage-tree Hill. From Plan No. 2 it will be seen that the strata in the extreme western workings of the Tasmania mine are dipping south-westerly, and from Plan No. 3 it is seen that the south-westerly dip continues to be found throughout the Amalgamated West Tasmania Mine and in the workings of the Moonlight Mine east of the shaft. Throughout the Little Wonder workings, however, the strata dip to the north-east, as they do northward, and a reef has been found which has been assumed to be the continuation of the Tasmania reef. The evidence in favour of the deviation theory seems stronger here than at the main fault, for the heave is different at different levels, an unusual thing in case of faults but normal for deviations. The reef appears to be heaved 40 feet at No. 1 level, 61 feet at No. 2, and 100 feet at No. 5. This increasing heave at different levels may, however, to my mind, be accounted for without accepting the theory of the reef having deviated, by the explanation that the stone met with on the western side of this cross-course belongs to a different reef from that left on the eastern one,—in fact, that the stone on the western side is the Moonlight reef, and on the eastern one the Tasmania reef. It will be seen from Plan No. 1 that, taking the general line of the series of viens forming the Little Wonder, Moonlight, and West Tasmania reefs, it is due to strike the cross-course very near to where the Tasmania workings have struck quartz as above described. The increasing heave of the fault would then be simply due to the differences of dip of the intersections of the two lodes with the plane of the fault. On this supposition it would only be a coincidence that the two bodies of quartz were found so near to one another at the fault. The explanation gains in plausibility when the evidence at the main cross-course is taken into account, for this, as has been shown, almost certainly proves that the reef with its enclosing country has been heaved to the northward. This implies the existence of two faults, one on each side of the heaved country. The pre-existence of the two faults is equally implied by the deviation theory, and their general or approximate parallelism would render their being of contemporaneous origin probable in any case. If we assume this to be true, and believe that the wedge of ground between the two faults has been heaved nearly horizontally northward, it will be seen that the Tasmania reef would thus be brought 240 feet nearer to the Moonlight one. If the wedge is supposed to be forced back southward till the Tasmania reef is again continuous at the main cross-course, the ends of the two reefs at the second cross-course would be 280 feet apart at No. 1 level instead of 40. There are certain considerations with regard to the nature of the reefs themselves that make it more likely that the reef west of the second cross-course is the Moonlight one and not the Tasmania. East of the main cross-course the latter, though subject to minor bendings and sinuosities, preserves a fairly straight line of strike (N. 48° E.) throughout its length. Between the two cross-courses this same strike is fairly well preserved, though several small heaves break the continuity of the line. We may therefore say that all the reef east of the second cross-course preserves a straight line of strike. In the same way the reef, or run of reefs—for there appear to be a number of more or less parallel veins—in the Little Wonder, Moonlight, and West Tasmania mines, which for convenience I have been calling the Moonlight reef, preserves a fairly straight course (N. 56° W.) up to the cross-course. It seems almost impossible that this fault should cause the reef to veer through such a large angle as 76°. The theory that the reefs are different ones seems far more probable. This probability is increased when the difference in the character of the reefs is taken into account. The Moonlight reef is notoriously bunchy, consisting of blocks of quartz which rapidly thin out to mere strings both in strike and dip, while the Tasmania reef, though sometimes pinched, preserves with great uniformity a continuous body of stone. It would be a curious and unlikely thing that the mere deviation of a lode from its former course should effect such a change in its character. The only feasible explanation of such a fact would lie in the statement that while the Tasmania reef runs across the strata of the country, the Moonlight one runs nearly with them (though crossing them on the underlay); and while the former traverses sandstones, the latter lies in grits and conglomerates, which might be expected to break more irregularly. The workings of the Tasmania mine on each side of the second cross-course show the difference in the nature of the two reefs; on the eastern side the stone is fairly continuous, but on the western one it had the same character as the Moonlight line—blocky and irregular. Immediately west of the cross-course there was good auriferous quartz from surface down to No. 2 level, but below that point the stone gave out, and at No. 3 and No. levels only a " track" of the reef was visible. On driving westward also along the reef at No. 1 level the quartz soon dwindled to strings, and though these were found to lead on to several bunches or blocks of quartz, no regular body of stone could be got; in fact, the behaviour of the lode in this part of the Tasmania mine has been exactly the same as in the mines on the Moonlight line of reef. From all these considerations taken together, I feel nearly certain that the workings of the Tasmania mine, by going northward at the second cross-course, have left the Tasmania reef and struck a portion of the Moonlight line.

If we suppose, then, that these two lines of reef are separate, and existed before the faults broke them they must have either joined together or crossed one another, the latter being the more probable on account of their directions being so nearly at right angles. Should they have done so, traces of their extensions past the intersection should be met with. No sign has yet been seen of the Tasmania reef west of the second cross-course, but no great amount of prospecting for it has been done. There appear to me, however, to be reasons to believe that extensions southward of the Moonlight line of reef have been found Ever since the opening of the field a good deal of gold in quartz has been got along the eastern slopes o the Cabbage-tree Hill from end to end. The long drives into the ridge of the Beaconsfield, Bonanza Leviathan, and Cosmopolitan companies testify to the general local belief in the existence of lodes running with the ridge, that is, across the line of the Tasmania reef. Auriferous quartz veins have been cut i various places, the most important workings on them being those of the Cosmopolitan Company. Bearing in mind that the Moonlight reef appears to consist of a number of veins running with the ridge, and tha these are very irregular and bunchy, it seems very probable that the leaders found to the south of the lin of the Tasmania reef are an extension of the run of veins found north of it.

If, then, the Tasmania reef has been lost west of the cross-course, where would be the most likel place to find it again? Owing to the sidethrow above mentioned, and to a twisting round of the strat east of the main fault so as to make their strike more westerly than that of those on its west side, it is no possible to accurately estimate the amount of downthrow of it, and hence the heave cannot be predicted Any heave, however, should be to the southward, hence the most probable position of the faulted portio is to the south of a line connecting the Golden Gate and Britannia shafts. It is most likely to pas through either the most southerly section held by the Amalgamated West Tasmania Company or that the Bonanza Company, but it may even be heaved to the south of the Bonanza section altogether, thoug this is not likely. It may seem incredible that the reef should have remained so long undiscovered if passes out through any of these sections, but an examination of the ground shows that very little systematic prospecting has been done, and on the western slope of the hill there is often a good deal of surface *débris*. Should the reef happen to be thin at its outcrop it might easily escape notice. The prevalent notion, too, that the Tasmania and Moonlight reefs are one and the same might have a good deal to do with diverting attention from this part of the ground. The first discovery of gold, if I have been correctly informed, was made west of the second cross-course, and on what I consider to be the Moonlight lode ; the fault was then encountered, and soon afterwards the Tasmania reef was picked up on the other side of it. The belief once held (if my information is correct) that the Phœnix shaft was on about the line of the reef shows that it was not till a good while after the lode had been first found that its true direction was ascertained. The discovery of the identity of the reef near the Golden Gate shaft with the one in the workings near the top shaft, as it is called (see Plan No. 2), was required to disprove the belief that it had not continued on or about the line of Dally's first discovery.

Before leaving the subject of these two cross-courses, a rather noticeable feature in them should be mentioned. The hade of both gets flatter towards the north-west end of the workings on them, consequently the drives at the different levels diverge fan-like, when seen in plan. This divergence is plainly seen on Plan No. 2 at the second cross-course, but that at the main cross-course is not shown. Here, indeed, it would appear that the dip of the fault changes from easterly to westerly, the Nos. 3, 4, and 5 levels lying to the east of the line of fault at No. 2, while No. 6 is to the west of it. The plan of this part of the mine is taken from the surveys sent annually to the office of the Inspector of Mines, and ought to be correct, but I have grave doubts of its being so. In all the levels the hade of the fault is to the westward, and the underground captain of the mine, Mr. Swanston, told me he had never known it to be otherwise in the stopes on the quartz found there. The large plan at the mine made by Mr. Davies, the mining manager, shows all the drives on the cross-course as lying successively further and further to the westward of its outcrop on the surface, and also exhibits the fan-like divergence of the levels at the north-west end, just as in the second cross-course. I cannot but think there is some mistake here in the official surveys from which my plan is taken.

Besides these two principal faults there appear to be a great number of smaller ones running more or less parallel to the ridge of the Cabbage-tree Hill. A somewhat larger one, but apparently of no great importance, seen in the Cosmopolitan mine, is shown on the plan, and traces of numerous others are met with in all the workings along the hill from the Garfield adit to the Cosmopolitan mine. Quartz is often found on these slides, and occasionally carries payable gold. As the axis of a syncline running N. 37° W., which as seen on Plan No. 3 passes just west of the Moonlight main shaft, has much the course of the generality of these slides, there is some foundation for suspecting that these fractures were caused by the force which caused the flexures seen in the section. There is a certain amount of probability that the veins of the Moonlight line of lodes themselves are connected with this series of fractures. I have not, however, been able to detect any faulting of the beds of country rock by these lodes, yet lying as they do almost in the same line of strike as the beds, which in this part of the field are very similar to one another, a considerable amount of faulting might easily escape observation.

Going now to the eastern end of the Tasmania mine, we shall inquire if there is any evidence of faulting here which would give a clue to where to look for the continuation of the reef in this direction, for hitherto it has not been discovered. By actual working the lode has been followed to a short distance east of the boundary between the old Lefroy and Florence Nightingale sections. The deep lead previously described cuts it off in all but the deepest level. As the lead is manifestly of much later formation than the reef, and is simply a river channel cut through it, it is absurd to ascribe to it, as is often done, any inimical influence upon the lode. The simple erosion of a river channel cannot fault or disturb in any way the continuity of the solid country from which it is carved out. Something, however, has happened to this reef, for it is not cut either in the long cross-cuts of the East Tasmania Mine or in those of the Dally's United. If the reef had continued on its course it would pass a little to the north of the East Tasmania shaft, which would strike it at about 350 feet. But no sign of it has been seen in the cross-cuts from the shaft. It is evident that one of three things has taken place, (1) either the reef has been heaved a very long way to the north or to the south, or (2) it has dipped deep in the strike with what is known as an "endlong dip," that is, instead of the outcrop coming to surface it has only come partly up through the ground, and the drives have therefore passed over it, or (3) the reef has died out altogether. The first of these is the most likely supposition. The second was to have been tested by the East Tasmania Diamond Drill bore, but unfortunately this had to be abandoned without proving anything on account of breakage of the rods, and loss of a portion of them in the bore. The third supposition is possible enough, but not to be contemplated until the other two have been proved to be impossible.

My belief that a large fault exists between the Lefroy shaft and the East Tasmania bore is founded on the relative positions of the limestones met with in the bottom of the Ophir Company's bores, and in the Dally's United Mine and East Tasmania bore, also on the marked difference in the strike of the country in the East Tasmania Mine from that in the Tasmania Mine. A glance at the section given herewith shows that in this part of the field there are two principal limestone bands, one met with in the bottom of the East Tasmania shaft, the other, and much larger one, struck at 458 feet in the East Tasmania bore, and also cut in the south drive from Dally's United shaft. From the plan it may be seen that there is no room for another large limestone band to exist between this one and the eastern workings of the Tasmania Mine. Now, what appears to be a very large body of limestone exists under the deep lead in the Ophir ground, for the Ophir diamond drill bore bottomed on limestone, as did Orchard's shaft also. The assumption that this large limestone body is the same met with in Dally's United Mine is therefore a very reasonable one. To confirm this belief, another band of limestone is found at the crossing of Weld and Crowther-streets, at about the same distance from the Ophir limestone as that in the East Tasmania shaft is from that in the Dally's Mine. While this gives great probability to the theory I am about to bring forward, it is only fair to point out that the whole argument depends on the identity of these limestone bands. When we come to try to connect the Ophir limestone with Dally's it is at once apparent that something is out of joint. An extensive series of observations of the strike of the country rock in the Olive Branch adits, Tasmania Mine and other long adits running into the Cabbage-tree Hill, of which more hereafter, has proved that the average strike of the strata in these is N. 53° W., while a careful examination of the north drive from the East Tasmania shaft shows that there the strata strikes N. 42° W. This difference of itself would suggest the existence of a fault. But neither of these lines of strike will connect the two bodies of limestone, thus again rendering the presence of a fault between them probable. I have accordingly on the plan drawn each limestone as having the strike of the nearest strata to it which have been measured. The exact position of the fault is of course doubtful, and its direction can only roughly be ascertained by noticing that it has not been cut in the East Tasmania, Dally's United, Tasmania, or Cosmopolitan workings. As it must, therefore, have much the same course as the main Tasmania fault, it has been drawn parallel to the latter on the plan. The commonness of the occurrence of parallel faults in disturbed districts makes it likely to begin with that these would be roughly parallel. Looking at the positions of the faulted portions of the main limestone on the plan, and remembering that the workings of the East Tasmania and Dally's United mines have shown that the strata here still have a north-easterly dip, it will be seen that the western must be the downthrow side of the fault to bring the strata into their present position. A downthrow of the western side of the fault would have the effect of heaving the Tasmania reef so that its continuation on the east side would be to the south of its line on the west. The amount of heave of the strata not being extremely great, the heave of the reef could not be very extreme either, but could easily be sufficient to allow of its passing between the north end of Dally's United and the south end of the East Tasmania drives. A somewhat unexpected confirmation of this theory was furnished on plotting the position of the limestone struck in the East Tasmania bore and that got in the Dally's United mine. The dip of the strata (63°) was easily ascertained by measuring the cores brought up by the drill, and consequently the position of the top of the limestone at the level of Dally's United workings was easily found. But on joining the horizontal traces of the bed in the two places they are found not to correspond with the average strike of the country, and lines drawn through them parallel to this are found to be 104 feet apart. It would seem, therefore, that there is a fault of some sort between these two points. Now, in examining the Tasmania reef I have frequently remarked that the beds of country on the hanging wall do not correspond with those on the footwall; that the reef itself, in fact, is formed in a line of fault. This is a common enough occurrence in lodes, movement of the walls having taken place after the opening of the fissures. At No. 6 level of the Golden Gate section of the Tasmania mine a good opportunity is afforded of measuring the amount of heave of the beds of country. For some little distance westward from the shaft dark bluish sandstone is found on both sides of the reef; on the footwall side this is underlaid by white sandstones, but the dark stone continues on the hanging wall for 104 feet further, when the white sandstone comes in under it also; thus the country rock beds are heaved 104 feet westerly by the reef. As above seen, this is just the amount of heave of the hypothetical fault lying between the East Tasmania bore and Dally's workings, which is strong evidence that the reef lies somewhere there. If, now, we further remark the difference of strike of the portions of country on each side of the large north-westerly fault, which for convenience we may call the Lefroy fault, it is seen that the amount is 11°. Let us also notice that the strike of the country west of the Tasmania second cross-course is as nearly as possible identical with that of the strata east of the Lefroy fault, and that the country between these two large faults has fallen downwards—the faults being thus "trough faults." It has been seen that there is evidence of strong thrust from the southward having accompanied the downthrow of this piece of ground, and it is likely that the difference of strike of the portion in the trough between the faults from that east and west of them is due to an oblique thrust having screwed it round more to the north-west. If, now, the country containing the Tasmania reef be screwed back again so as to have its strata with their original strike of N. 42° W., the course of the reef would be N. 59° E. instead of N. 48° E., as at present, and this is the course we should expect it to have east of the Lefroy fault, and in the extension west of the Cabbage-tree Hill as well. This line is laid down on the plan as the position of the hypothetical fault occupying the probable position of the reef above referred to, and it will be seen that it goes easily between the ends of the East Tasmania and Dally's United drives. The ground lying between these ought most certainly to be tested by extending them, best towards one another. The reasoning as to the reef lying between the ends of the two drives may appear to be only ingenious theorising, and I am quite well aware that many objections could be raised to the argument: still the belief that such is the case has been forced upon me in the endeavour to reconcile and explain existing facts. The strongest point in favour of it is that it is difficult to imagine where else the reef can go. A very great heave would be required to take it either south of the Dally's or north of the East Tasmania cross-cuts. The deductions from the position of the country rocks thus agreeing with *primâ facie* probability, I feel as certain as the nature of the case permits that the eastern extension of the Tasmania reef lies where indicated on the plan.

There appear to be at least two other large faults in the Beaconsfield district—one crossing the Cabbage-tree Hill to the south-east of the Cosmopolitan and Peru mines, and another running along the Brandy Creek between the Little Wonder and Brandy Creek mines. The existence of these is indicated by the difference in strike of the strata on each side of them and by the want of agreement in position of various recognizable beds. It is not claimed that either the position or direction of these faults is correctly represented on the plan, the lines being drawn to indicate only approximately where they may be met with. To locate them with accuracy would require a very close survey of the ground in their neighbourhood, and as sections, and even exposures of the solid rock are rather rare there, it might even then prove impossible to do so. The whole district seems to be much faulted, and there are probably many faults yet to be discovered.

Strike and Dip.—In the course of my survey of this field it was found necessary to ascertain as exactly as possible the strike and dip of the strata, and some hundreds of observations of these were taken. Though, as might be expected, there were considerable local variations due to petty disturbances, it was found that on the whole the average strike of the various blocks of country separated by the main slides was fairly constant for each, though that of each block was generally different from its neighbours. The average direction of the strata as thus found is shown on the general plan, and actual observations in the mines are plotted on Plans Nos. 2 and 3, and some taken in the gorge of Blyth's Creek on Plan No. 1. Owing to the small scale of the latter, the actual observations in the Garfield, Olive Branch, Leviathan, and Cosmopolitan adits are not figured on it. The mean of the measurements in the Olive Branch gives a strike of N. 58° W., in the Leviathan N. 51° W., in the Upper Cosmopolitan adit N. 54° W., and in the Lower Cosmopolitan adit N. 47° W. These altogether give the same average strike as is found in the eastern part of the Tasmania mine, N. 53° W., but they also give reason to believe that the strike of this block of country becomes more westerly towards its northward end. This would accord with a flattening of the dips of the faults towards their northward ends, as observed above in the case of the two Tasmania cross-courses, and with the somewhat rotatory motion previously mentioned as being the course of the difference of strike of the strata east and west of the Lefroy fault. In the Garfield adit the rock is much disturbed and the strike very variable in consequence, but the measurements give an average strike of N. 40° W., which agrees very well with that calculated from those in the West Tasmania, Moonlight, and Little Wonder mines, viz., N. 42° W.

Influence of Country Rock on the value of the Reefs.—One of the objects of this survey was to ascertain as far as possible if there was any difference discernible in the gold value of the reefs as they passed through the various strata. It has often been noticed in the history of mining that certain bands of country appear to enrich the reefs passing through them, while others have the contrary effect. In the present instance the evidence on this head shows no marked influence of the different beds on the value of the reefs, except in one case mentioned below. The Tasmania reef has been auriferous throughout all the strata traversed by it. The richest stone is found in a number of distinct "shoots" or "chutes," which, according to Mr. Davies, the mining manager, are often distinctly separated from the rest of the quartz by small sandy and clayey partings or "selvages". Outside of the "shoots," however, the quartz has been generally payable. The shoots dip easterly, conforming pretty closely with the dip of the country rock. Some remain narrow and constitute roughly parallel bands in the quartz, but two or more widen out very much in the lowest levels of the mine. The strata that have proved "favourable country" for gold in this mine may be said to be all those between the lower beds of grits and conglomerates and the main limestone bed. Owing to the loss of the quartz west of the second cross-course below No. 2 level, it is not known if the black carbonaceous grits there carry any gold. In the Moonlight and Little Wonder mines these black strata have been almost altogether barren of gold, though recent discoveries of the metal in quartz leaders cut in the new eastern Moonlight cross-cut at 422 feet give hope that they are not always so. In the mines on the Moonlight line of reef rich stone has been got in the upper levels of all, and as long as the quartz was found in the light coloured grits and sandstones, but on getting down into the black country the stone has become unpayable in every case, and, with the exception just spoken of, very rarely contains any gold at all. According to experience up to the present, therefore, the lower beds of the grits and conglomerates have proved to be "unfavourable country."

The gold-producing capabilities of the strata lying east of the present Tasmania workings and of the slate underlying the grits, have yet to be ascertained. With the exception of the limestone bands, which are not generally considered to be favourable for gold, the bands of slate, schists, and sandstone seen to the east of the Cabbage-tree Hill are similar to those proved to be auriferous a little lower in the series, and will probably therefore also be favourable. The value of the reef in the limestone remains to be proved by actual workings. Gold has sometimes been found in limestone, and it is quite possible that the reef will not suffer in value in passing through it in the present instance; still, the difference between slate or sandstone and limestone country is so great, both chemically and physically, that some change in the contained reefs may be expected, and no great hopes should be entertained until the metal is actually proved by working to be present in them.

As regards the blue slate found west of the Cabbage-tree Hill there is no proof yet as to whether it is favourable or unfavourable country. No known auriferous veins have yet been found in it, but none of the proved auriferous reefs have yet been traced into it, and on almost every goldfield there are numbers of barren veins even in the most favourable country rock. Slate of similar character is generally regarded as good country for gold, and there is therefore reason to be hopeful as to the future of the reefs when traced into this. Should a western continuation of the Tasmania reef be discovered it will soon pass into this slate, and the auriferous nature or otherwise of this will then be soon proved. The same country will be found at a depth of from 800 to 1000 feet in the Little Wonder, Moonlight, and West Tasmania mines. It seems to me that the most useful work these companies could now do would be to combine to sink the Moonlight shaft, which is the deepest and best constructed of the three, to below the "black country" in the hope of the reefs improving when they pass through it into the slate. It is probable also that by sinking thus the reefs would be got further away from the contorted strata, and there would then be more hope of having them solid and continuous, and of the numerous veins combining into one lode. The upper levels are practically exhausted, and the present lower ones are barren, hence all that remains for these mines is to find new veins or to sink for better country. The latter course commends itself as a genuine mining enterprise of the sort that has saved many a mine from being given up, and led to great success.

Remarks on the Prospects of the Mines.—Passing on to the consideration of the light thrown by this survey on the future prospects of the mines as to permanency and value, it is seen that the Tasmania mine stands in a most favourable position. There is an undisturbed body of stone from the main cross-course to the Lefroy fault, going down in favourable country to at least 1000 feet, and probably much further than it can ever be followed by mining operations. The favourable country is dipping to the eastward, as also are the shoots of gold, and it is to the eastward that the ground held by the owners of the mine stretches furthest in the direction of the dip of the reef, and consequently contains it to the greatest depth. The Phœnix diamond drill bore proved that the reef was as strong as ever at over 700 feet and rich in gold. The lode is evidently a true fissure vein, or it could not have faulted the enclosing strata. There seems no reason to doubt that it will be as large a gold producer as in the past for many years to come. The powerful new pumping appliances now in course of erection will easily cope with the water which has hitherto retarded progress so much, and to be able to overcome a still greater inflow should such occur.

The Phœnix Company should have a valuable property, but have difficulties to overcome in working it, as it lies beneath the Tasmania workings, and hence the mine will be liable to get the water from these. Owing to the shape of the boundary between the two holdings the workings of the Tasmania mine will not be of much benefit to the Phœnix until they are down to about 800 feet, as there is only a small triangular portion of the reef belonging to the latter company above that level. There are thus years of work before the Tasmania Company, if they choose, before their pumping will help the Phœnix mine. The owners of the latter, if they wish to work it, will have to provide drainage plant of their own. This would require to be equally powerful with the large new plant of the Tasmania Company, for there can be little doubt that the lower workings would soon drain the upper ones dry. The strata are very loose and open, and water gets through them freely. This was shown by the diamond drill bores both of the Phœnix and East Tasmania Companies; in neither case could the bore be kept full of water, even when tubed to the bottom with iron tubes: this, too, when the bottom of the bore was 200 and even 400 feet below the level of the water in the Tasmania mine. Another proof of the porous nature of the country is seen in the fact that there is rarely any water in the bottoms of the Moonlight, West Tasmania, and Little Wonder shafts, though these are all a long way below sea level. During the recent flooding of the Tasmania mine, however, water rose in the Moonlight shaft and remained until the former was unwatered, when it drained out of the latter also. If water can communicate so easily through the rocks with points so distant from the Tasmania mine as the East Tasmania bore and the Moonlight shaft, it seems incredible that it would not get from the Tasmania into the Phœnix mine, on the same reef and closely contiguous. It would probably be possible enough to sink the Phœnix shaft to 900 or 1000 feet without a very large pump, but when the mine was opened out, and the "bleeding" or "weeping" surface much increased thereby, the open nature of the rock is such that it would be impossible to prevent the water from the Tasmania mine finding its way down. Some water might be cut off, and led to the Tasmania's shafts to be raised, but only a small proportion, and one getting less and less as the Phœnix workings are extended. The question of drainage would be a serious one between the two companies, even if both had powerful pumping appliances, as it would be perfectly impossible to fairly allocate the burden of pumping expense between them. Only by a mutual friendly arrangement between the two as to sharing the expense could endless disputes and litigation be avoided, as the extensions of the workings of both mines would cause the inflow of water into each to be continually varying, so that no hard-and-fast rule could with justice be laid down as to how much was the proper share of each party. The best way out of the difficulty lies in an amalgamation of the two claims. All the pumping could then be done from the New Tasmania main shaft. The Phœnix ground, lying further west than the Tasmania's future deep workings, is nearer than the latter to the lower deep strata of the country, hence in the western workings the Phœnix will encounter the grits and conglomerates long before the Tasmania will. The ground is so pegged out, indeed, that the latter mine will carry the bulk of the most favourable country with it eastward. While, therefore, the former mine will doubtless have a good deal of gold in it, it must be remembered that as it goes down it gets nearer and nearer to the unfavourable black grits, and to the yet unproved slates, and its future has nothing of the same certainty about it that its neighbour's has, in consequence.

The Amalgamated West Tasmania, Moonlight, and Little Wonder mines, being all on the same line of reef, may be dealt with together. Their prospects and future policy have already been referred to, but a few more remarks may be made upon them. The Little Wonder and Moonlight have been the best producers of gold, the upper levels having been very rich. There are several veins more or less parallel to each other in these mines, and as these often pinch to mere strings, and the ground is greatly broken and disturbed in addition, the following of them has been a matter of great difficulty, and they have been often lost and not always found again. The exact number and relationship of them is therefore doubtful. In the main workings of the Little Wonder two larger branches diverge northward from near the shaft, and in the opposite direction come together and run into the Moonlight ground. The old Olive Branch Company had a small portion of this reef in the south-west corner of their western section, and worked it with considerable success till it dipped away into the Moonlight ground. The general dip of this line of reef is to the south west. The Moonlight Company have been very persevering in their attempts to find gold at a depth, and have done a great deal of prospecting at their 422 feet level, assisted in this by a subsidy from the Government. Their long south-western cross-cut, though unsuccessful in cutting any reefs of value, has proved a considerable stretch of ground, and has afforded an excellent section of the strata that has been of the greatest service to me in preparing this Report. The old Olive Branch sections having fallen into their hands, they are now driving eastward from the main shaft, and have cut some leaders and bodies of quartz that give promise of greater success in the future. The development of these discoveries is suspended until the completion of a contract for driving this eastern cross-cut. One leader contains a little gold. In the workings near the surface the Moonlight reef appeared to dip north east—that is, away from the shaft,—then it became vertical, and finally turned towards the shaft and passed through it, dipping south-westerly.

This has often led to a suspicion that there were two "legs" to this lode, one dipping north-east and another south-west. Owing to the proximity of their boundary line, the Moonlight Company were not able to test this supposition until lately, when the Olive Branch ground was acquired, and these discoveries in the eastern crosscut give some support to it. The Olive Branch Company also drove easterly from their shaft, but did not get any lodes of importance. The belief in an easterly leg of the Moonlight lode seems borne out by last year's (1890) workings of the West Tasmania Company, who, after picking up the reef in the old surface workings of the Moonlight, followed it to the south-east, and extracted 507 tons of quartz, which yielded 549 ounces of gold. This stone was found to dip to the north-east, and at 200 feet passed through the West Tasmania shaft. Workings on it at the 150 feet level were carried on up to the Olive Branch boundary. This is the only gold-bearing stone of any consequence yet got in the West Tasmania Mine, with the exception of a little that was obtained in the 315 feet level where it joined the Moonlight 250 feet. All the other workings have been on thin veins and tracks not worth stoping out. This lode was of a very peculiar character, and extremely difficult to follow. The quartz was found in the most irregular bunches, connected by nothing but clayey "tracks" and occasionally thin veins of quartz, and was enclosed in a jumbled mass of sandstone and grit fragments, mixed with clay and sand. On examination I came to the conclusion that there was here a rather wide lode fissure filled with broken fragments of the wall-rock, amongst which the quartz had been deposited, thus accounting for the very irregular distribution of the latter. The filling of the lode is mainly composed of loose angular fragments of sandstone, grit, and conglomerate, sometimes crushed or disintegrated into loose sand and gravel. In places open spaces were found into which an arm could be thrust up to the shoulder. Throughout the broken formation no trace of regularity of stratification could be observed, but in one or two crosscuts through it the solid regularly stratified rock was to be seen, proving the nature of the occurrence to be of the "mullock lode" type. Where the main shaft had been sunk through it there was no definite body of quartz, and consequently the fact of there being a lode was not noticed. From the size of this formation I should expect that the fracture of the rocks shown by it is an important one, and, as lodes filled with fragments of wall-rock frequently are found on being followed to narrow and become filled with quartz or other proper lode material, I think that it would be well worth while to trace this one further, in the hope that it would so change. All the quartz so far found in it has been highly payable, and, should the filling change to a defined quartz reef, there would be every hope of it proving payable also.

There is a somewhat similar lode to that just described, and also dipping to the north-east, found in some workings from what is known as the Moonlight No. 3 shaft. A drive on this lode at the 60 feet level showed it to be filled with a broken mass of country rock and occasional pieces of quartz. No gold was got in these, however. This mullock lode also should be traced further, in the hope of its changing to quartz.

As above said, the future of these three mines depends on finding new lodes or branches of those already known, or on sinking deeper. A good prospecting work would be a drive from the Little Wonder shaft south-west into the Moonlight ground far enough to make sure that none of the veins worked upon in the No. 5 level of the latter mine have turned off along the boundary of the two sections. A crosscut north-east from the same shaft would also prove some very likely ground. Sinking, however, seems to me the best policy of all.

Only two other mines now working have found reefs—the Cosmopolitan and the Brandy Creek. The latter was shut down on the only occasion when I had an opportunity of visiting it, and I was only able to go hurriedly through the former once, consequently I have little to say about them. The Cosmopolitan workings are unfortunate in being situated in what appears to be a regular network of small slides, which have cut off the quartz repeatedly. A great deal of driving has been done to get to the reefs, but very little real work on them. Good gold-bearing stone has been at times obtained, and, if the mine were opened up better, it might produce a good deal, but the numerous slides have hampered work very sadly. It will be necessary to get the reef in less broken country before work can be profitable.

Marble.—The blue-black crystalline limestone found in the East Tasmania bore takes a very good polish, and is really a very handsome marble. When polished it is nearly black, the bluish shade in the colour being only perceptible on close inspection, and numerous veins of pure white calcite give variety and beauty to it. The stone works well, being close-grained and hard. There should be no difficulty in getting blocks of uniform texture and any required size from Dally's quarry on Blyth's Creek (where this marble is being burned for lime), or more easily still from the large masses cropping out at the head of the Flowery Gully. If worked by skilled marble-workers I have no doubt that this stone could be sold profitably in considerable quantities for ornamental and monumental purposes. The quantity easily got at is very large, and the facilities for quarrying are good ; while the proximity to a shipping place, and ease with which tramways could be constructed from it to the quarries, are very favourable for cheap transport to either the local or the Australian markets.

The pale bluish white marble found at the old limekiln at the second bridge on the road from Beaconsfield to Launceston would also be of commercial value if easily obtained. As the workings of the old quarry on this bed are now full of water I cannot speak as to the size of it, or as to whether large blocks could be got of uniform texture and free from flaws. If, however, the loose stones lying about fairly represent the general quality of the marble it would be well worth quarrying.

Besides the marbles there is another stone in the Beaconsfield district that would be very useful for ornamental work, namely, the Serpentine that occurs abundantly in Anderson's Creek. This is found of great variety and beauty of colouring, and could be made into a great number of highly ornamental articles. Various shades of green and very pretty mottled serpentine are quite common.

Appendices.—As no topographical features are shown on the plans accompanying this Report, I append a number of heights above sea level of various points throughout the district. These were taken by means of an aneroid barometer, and consequently are only rough approximations to the true levels, but will be useful for purposes of comparison.

I also append sections of the Phœnix and East Tasmania diamond drill bores.

Thanks.—During the course of my survey of the district I received much useful information and many courtesies from the mining managers and other gentlemen throughout the district, whose help and kindness is now gratefully acknowledged.

I have, &c

A. MONTGOMERY, *M.A., Geological Surveyor.*

The Secretary of Mines, Hobart.

Appendix No. 1.

HEIGHTS above Sea Level of Points in the Beaconsfield Goldfield, approximately determined *Aneroid Barometer.*

	Above H.W.M. Feet.
Weld-street, opposite Club Hotel	105
Top of Lefroy shaft	125
Florence Nightingale shaft	153
Dally's United shaft	117
Golden Gate shaft	186
Ballarat shaft	168
Ophir shaft	127
New main shaft, Tasmania	159
East Tasmania shaft	86
West Tasmania main shaft	352
Moonlight main shaft	334
Moonlight No. 3 shaft	262
Little Wonder shaft	321
Little Wonder shaft on Garfield Section	321
Mouth of Little Wonder main adit	204
Garfield adit	213
Bonanza adit	172
Leviathan adit	195
Cosmopolitan upper adit	204
Cosmopolitan lower adit	96
Top of Old Britannia shaft	276
Phœnix bore	213
East Tasmania bore	86
Ophir bores	120
Denmark shaft	110
Bonanza air shaft	231
Cabbage-tree Hill on line of Bonanza tunnel	411
Old shaft near Phœnix and Bonanza boundary	330
Leviathan air shaft	321
Kohinoor shaft	375
Cosmopolitan shaft	258
Hematite shaft	195
Air shaft on lower Cosmopolitan adit	163
Old New Providence prospecting shaft	348
Tasmania open cast workings	348
King and Eastman's alluvial workings	249
Old Stanley shaft	101
J. T. Allen's bore	65
New Brandy Creek shaft	155
Pease's shaft	164
Old Brandy Creek shaft	177
Excelsior shaft	190
Dundee shaft	191
Mouth of London adit	155
Brandy Creek old surface drive	159

Appendix No. 2.

SECTION of Strata afforded by the Phœnix Company's Diamond Drill Bore.

Strata.*	Thickness.		Total Dept	
	ft.	in.	ft.	in.
Alluvial surface matter	4	6	4	6
Hard, brittle, whitish, and yellowish fine-grained sandstone, breaking into small rhombohedral fragments; very much jointed; would not form core; contained a few very thin quartz veins ; flinty and somewhat crystalline in texture	368	4	372	10
Fine-grained, dark bluish, somewhat crystalline, sandstone, much jointed, and yielding little solid core; contained occasional specks of pyrites; a band of grey micaceous sandstone at 472 feet, but only very thin	119	8	492	6
Light grey and whitish sandstone, with occasional bands of grey slate; impressions of fossils rather numerous, but imperfect; sandstone more granular and porous than the preceding bands ; gave a few inches of solid core at times	213	0	705	6
Tasmania reef—Quartz containing iron and copper pyrites; gold freely visible	24	6	730	0
Dense hard crystalline dark blue or black sandstone, with a good deal of pyrites in it	50	7	780	7
Total	780	7	780	7

* Dip of strata 58° (average of 12 measurements of angle of dip visible on cores).

SECTION of Strata afforded by the East Tasmania Company's Diamond Drill Bore.

Strata.*	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface soil and clay	12	0	12	0
Brown, grey, yellow, and bluish sandstone, with small quartz veins; some grit as well as sandstone, also thin bands of slate	68	10	80	10
Slate similar to that found in the 100 feet level of the East Tasmania mine, rather soft, greenish, arenaceous, and calcareous; vein of calcite and pyrites 2 inches wide at 116 feet	35	2	116	0
Impure silicious limestone with calcite veins; vein of dense whitish grey hard quartz at 120 feet	64	0	180	0
Dark black, bluish grey, light grey, and dense blue grey fine grained slates, containing a little pyrites and a few small quartz and calcite veins	278	0	458	0
Dense dark blue fine grained crystalline limestone or marble, very solid as a rule, but occasionally fractured. The drill ceased working while still in this rock	520	4	978	4
TOTAL	978	4	978	4

* Average dip of strata 63° (mean of 19 measurements of angle of dip shown by cores).

REPORT ON THE GENERAL GEOLOGICAL STRUCTURE AND TIN-BEARING GRAVELS OF THE GLADSTONE DISTRICT.

Geological Surveyor's Office, Launceston, 27th July, 1891.

SIR,

I have the honor to report having made a general geological examination of the Gladstone District, and more especially of the ground held there for tin-mining purposes, with the object of collecting information that might prove of service to the mining industry by throwing greater light upon the origin and mode of deposition of the tin-bearing gravels, their extent, and their distribution throughout the district.

A general view of the topography of the country round Gladstone is best obtained from the top of Mount Cameron, 1808 feet above sea level. The mountain consists of a cluster of rocky peaks connected by high ridges, the group being divided into three main spurs by the valleys of the Campbell's and Sapphire Creeks. It is isolated from all other neighbouring ranges, being surrounded on all sides by low-lying country, which slopes gently seaward from the foot of the mountain towards Boobyalla, and on the inland side rises gradually in rolling low ridges up the Ringarooma valley towards the foothills of the Blue Tier and the high ground near Branxholm. On the western side the wide flat low-lying valley of the Boobyalla River divides it from Mount Horror. Towards the eastward there is little high country, the low Ringarooma Tier and the distant Mount William being the most prominent features, but the whole consists of a succession of low ridges, separated by plains anl a few deeper valleys, that of the Ringarooma River being the most important. The land is generally but sparsely timbered, and large open spaces clothed with native grasses give it a park-like character. The open grass land generally denotes the presence immediately under the surface of a hard, somewhat ferruginous, cement layer or "pan," which is especially found covering the deposits of gravel. The ridges and slopes where the solid bedrock lies near the surface, when not too rocky, generally bear more vegetation than where the "pan" occurs.

The general aspect of the country as seen from the top of Mount Cameron suggests that the low-lying country has been planed down to a pretty uniform level by marine erosion, and has subsequently been furrowed into minor ridges and valleys by the action of running water and other sub-aerial agencies. It wonld therefore appear as if the sea had once covered all the low-lying ground and extended inland to the foot of the ranges. This appearance is general at intervals all along the northern coast of the Colony, and the probability is that, as a matter of fact, the land has risen very considerably since the end of the Early Tertiary (Palæogene) Period. This explanation is of great service in reading the history of the various gravel deposits, enabling them to be correlated and their differences explained with a success which no other theory appears to me to approach. Further evidence in support of it is given below.

General Geological Structure.—The bedrock visible throughout the district is either granite or ancient sedimentary slates and sandstones of probably Lower Silurian age. On these rest gravels of ages ranging from the early Tertiary down to the present time. No Upper Palæozoic or Mesozoic rocks of our Coal Measure series have, to my knowledge, ever been found in the vicinity of Gladstone intervening between these two formations. Recent basalts, probably of Tertiary age, are sparingly found, however, and must be taken some notice of.

Granite.—The Mount Cameron Range is part of a large mass of granite country which extends from between Boobyalla and Gladstone southward to Branxholm and the George's River, and includes the whole of the Blue Tier Range and its offshoots. The boundary between the granite and slate formations is a very sinuous line, but may be said to run roughly about N.W. and S.E. through a point just west of Gladstone township. The granite is of the same character as that composing the Blue Tier, the Billycock Tier, Mount Stronach, and other granitic hills of the North-eastern District, namely, a felspar porphyry consisting of quartz, mica (*biotite* mostly), and felspar in coarse granular mixture, with large felspar crystals porphyritically developed. In vughs in the granite the quartz frequently is found in large black crystals of fine quality. Generally the rock is of a whitish light grey colour, but occasionally it is red, the felspar being of a brick-red colour. In parts it may be seen of a warm cream colour, and without the large porphyritic felspar crystals. The rock is very subject to decomposition, the felspar rapidly altering to kaolin, and the mica to clayey and serpentinous earths. The insoluble quartz grains alone remain unaffected by the atmospheric agencies. They are angular, and rarely show any approach to definite crystalline form, and range from the size of small shot to that of peas, forming therefore a very light gravel when broken down by the weather and very readily moved by running water; whence it happens that the rarer large quartz crystals and masses found in vughs and veins of the granite being left behind by the lighter material, form a preponderating proportion of the heavier wash. This serves as some measure of the amount of concentration of the heavy material in the creek beds, for every cubic yard of coarse gravel must represent some hundreds of yards of broken down granite, as the latter contains only a very small percentage of vein rock and large crystals. Similar reasoning will show that if even a very small quantity of tin ore exists through the granite, whether in the rock itself or in small veins through it, the concentration has been sufficient to allow of very considerable quantities having been gathered together in the creeks. There can be little doubt that the granite does contain a little tin in its mass irrespective of any occurring in veins traversing it. Every little creek on the granite bedrock is found to contain some tin ore, and tin-bearing veins are so rare that they cannot be relied on as the source of this. In a previous report on the Blue Tier District I suggested that a good deal of the alluvial tin ore was derived from the disintegration of the granite bedrock, and my examination of the tin-bearing creeks of Mount Cameron tends to confirm that belief.

The fine quartz from the disintegration of the granite is a very useful indicator of the proximity of the bedrock. It is washed clean by rains, and gathered together by small runnels of water into white patches, often resembling small hailstones. If on examination the grains were found to be sharp and angular, I have found that in every case that came under my notice further search showed the bedrock to be immediately under the surface,—in fact, the surface soil was only disintegrated rock. Where, however, there was a considerable percentage of rounded water-worn grains, there was always alluvial material underneath. This simple observation was of great service when the nature of the bedrock was not at once visible. Where the fine quartz gravel has been much water-worn, it generally forms fine rounded grains like rice or barley in appearance and size.

The granite has been evidently intruded through the Silurian strata, as is shown by the very sinuous boundary between the two formations, and the fact that the slates and sandstones at the contact are often greatly metamorphosed and rendered somewhat crystalline. A shaft sunk on the Mount Cameron Company's ground went for some seventy feet through slate, and then struck granite. The strike of the Silurian beds is in many places fairly against the granitic masses, which thus cut them off sharply. The intrusions of granite are therefore post-Silurian in date.

In my former report on the Blue Tier District, the occurrence was noted of a second variety of granite traversing the above-mentioned felspar porphyry as dykes, and generally carrying a great deal of tin ore impregnated through it. Somewhat similar rock is also found at Gladstone and here, too, is apparently much more richly stanniferous than the ordinary granite. As at the Blue Tier it varies greatly in composition, being in parts composed almost wholly of quartz and mica or hydro-mica, and in other parts of about equal quantities of quartz and felspar, while in other places, again, all three constituents of granite are found. Much of the mica is white and silvery *(muscovite)*, thus differing from the black mica *(biotite)*, of the country rock. Quartz is generally predominant, however, and in much larger crystals than the felspar and mica ; hence though the rock is by no means a typical *quartz-porphyry*, in the absence of a better name this one may be given to it. Where veins traverse this porphyry the felspar is generally gone from their immediate neighbourhood and the mica become hydrated, while infiltration of silica has cemented the material into a hard solid rock. Often a vein of well formed vein-quartz runs through the centre of the altered mass. These veins are often very rich in tin ore, both in the quartz and in the altered country rock. Several of these quartz-porphyry dykes have been found in the Gladstone District; the largest, perhaps, being on the Fly-by-Night claim, where it lies between the Silurian formation and the main granite mass. This would suggest a probability of its being a contact alteration product, that is, that the portion of the granite coming in contact with the sedimentary rock had been altered in composition and crystallised differently from the main mass in consequence. As, however, there is not this alteration at other points of the contact, and, besides, the porphyry traverses the main granite itself on the Esk Company's ground, it would seem that its being a contact mass on the Fly-by-Night is only accidental. The intrusive character of the quartz-porphyry is not so clear as at the Blue Tier, and it may prove on further examination not to be a true dyke, but rather granite altered by fracture and infiltration of metamorphosing solutions. At present, however, I incline to the belief that it is dyke-stuff intruded though the granite.

Running a few degrees east of north from above the Esk Company's pumping plant on the east side of the river is another outcrop of the quartz-porphyry, and still another occurs further on on the old Empress claim. These may prove to be connected with the Fly-by-Night dyke, but as yet no attempt has been made to trace them through. Since my visit to the district I have been informed of the recent discovery of a large soft granitic lode rich in tin ore on the Mount Cameron Company's property, from the appearance of specimens from which I should think that it is probably connected with the adjacent Fly-by-Night dyke, if not really a continuation of it. On the Esk Company's sections, on the slopes towards Harden's Ravine, several tin-bearing veins have been cut by trenches, but I am not sure whether they are in another dyke of quartz-porphyry or are simply small lodes in the granite. They are small and rather irregular, but often carry excellent tin ore. More extensive trenching across their course is required to make clear their true nature. In the quartz-porphyry dykes tin-bearing veins are very numerous, and run in all directions. On the Fly-by-Night section there are a great many of them, and so much rich stone can be readily obtained as to render it probable that the rock would be payable if systematically worked. On Mallinson's section, No. 167, there is something more like a definite lode than the generality of the veins. Here, in the width of about a chain, are found three or four veins of quartz impregnated with silvery talc and flanked by bands of blackish greasy talc, the whole width of the lode bands ranging from one to five feet. Tin occurs pretty freely in these bands, and in what is said to be a bulk sample taken from a shaft on one of them as much as 12½ per cent. of dressed tin ore is reported to have been obtained. This lode is worth prospecting: it could easily be tested by a short adit and drives along its course. Neither here nor on the Fly-by-Night ground has any real mining work been done to try the lodes—nothing, indeed, but a few trenches and pits. Endeavours have been confined to searching for definite lodes to which it was supposed the numerous veins would lead. As the tin ore appears to be impregnated through the bulk of the quartz-porphyry generally, and segregated especially in the vicinity of the veins rather than confined to them, it appears to me that efforts should be made to ascertain the average value of the formation rather than to trace the separate veins. These do not seem at all likely to be permanent, and it is very doubtful if definite lodes exist at all in the formation. The experience of the Anchor mine at the Blue Tier in crushing the quartz-porphyry dyke there in bulk proves that this treatment is the proper one to pursue, and not rooting out small rich veins. No great amount of attention has yet been paid at Gladstone to the stanniferous dykes, but they are, in my opinion, promising enough to be worth a systematic trial, which would ascertain if they would pay for treatment in bulk. Both the Fly-by-Night and Mallinson's dykes offer extremely good facilities for cheap extraction of the ore by open quarrying. One per cent of dressed tin in the stone, taken as it comes, ought to pay all expenses and leave a margin of profit, provided that a sufficiently large quantity per diem were treated. This may seem to some an absurdly low estimate of cost of extraction and crushing, but numerous examples of successful dividend paying mines could be cited where the value of the rock mined is much less than that represented by one per cent of tin ore, and in some of these cases the ore has to be raised from a depth of as much as 2000 feet with concomitant pumping as well as winding expenses. It has been thoroughly demonstrated that no mines pay so well and steadily as those where there are very large quantities of low grade ore of only sufficient value to give a small profit over expenses of treatment on a large scale. Worked on a small scale they would be unpayable, but, with the greater economies possible in working on a large scale, handsome profits are realised. Great quantity of material dealt with is the secret of their success. What is required now, therefore, in the case of these dykes at Gladstone, is to ascertain the quantity and value of the stanniferous rock easily available. The course of the porphyry formations should be ascertained by trenches, and a number of small shafts should be sunk in them at regular intervals so as fairly to sample the rock. The stone from these shafts should be all crushed and dressed without any picking of good stone or rejection of bad. The result of the crushing would show what could be expected from the porphyry as a whole, and would allow of a calculation being made as to whether it could be made to pay when milled on a large scale. Even if the rock as a whole would not pay to work it would be seen by such a trial if it would be possible to select large quantities of payable stone without having to remove so much poor rock as to cause a loss. It may be pointed out that the cost of such a thorough test, implying as it does the provision of a small experimental battery for crushing the rock from the shafts, would not be greater than has to be sunk in preliminary prospecting operations in many other mines where the results obtained are often not nearly so definite nor the prospects so good.

Silurian Formation.—The bedrock underneath the township of Gladstone, and, generally, east and north-east from it, is composed of metamorphic slates and sandstones having an average north-and-south strike (my observations of strike vary from N. 7° E. to N. 15° W.), and standing nearly vertical, such dip as there is varying from easterly to westerly very frequently, and within short distances. Both the sandstones and the slates are, as a rule, rather soft, and easily weather to clays, but there are also hard bands of silicious semi-crystalline sandstones, which resist both atmospheric and mechanical disintegration well, and hence form a large proportion of the river gravels. The rock, as a rule, however, does not appear to have undergone any extreme metamorphism. Though continually searching for them I was not able to find any fossils in the formation, nor could I hear of any ever having been found. From the lithological character and mode of occurrence of the rocks, however, I take them to belong to the Silurian system.

Wherever the bedrock is bared by sluicing operations it is seen to contain many veins of quartz, some of white colour, some dull grey and very dense; these veins supply a large proportion of the gravel derived from this rock, the slates and sandstones themselves generally soon becoming reduced to clay and sand on account of their softness. Sometimes the vein quartz contains both tin ore and gold. Besides these small veins several larger quartz reefs have been found, and at one time it was hoped that Gladstone would become a goldfield, but the reefs all turned out badly on being subjected to practical trial. The most celebrated lode was that known as the Royal Tasman, close to the township. Out of a great many conflicting statements with regard to this, I incline to believe that one the truth which said that there was a small patch of auriferous stone in this lode, but that it very soon gave out and no more was found. The belief seems to be universal that the small crushings first obtained were "salted," and hence many persons regard the Royal Tasman gold as a fraud from first to last; but from the most reliable information I have been able to obtain locally from men who worked in the mine, I believe that there was really some gold genuinely got. The truth of this matter is of importance to the future of the District, for the failure of the Royal Tasman has utterly damned it in public estimation as an auriferous country, and hence prevented it from getting the attention which it fairly deserves. The Silurian formation elsewhere, at Beaconsfield, Lisle, Denison, Golconda, &c., and in Victoria has been the home of auriferous reefs, and there is rather reason to believe that such are likely to be found in the Gladstone District than that the formation should be barren. A good deal of gold is found in the alluvial gravels resting on and derived from the Silurian bedrock, as much as seven ounces to the ton of tin ore having been obtained in cleaning up the sluices used for saving the latter. The formation is therefore clearly auriferous round Gladstone as elsewhere, and all that the failure of the reefs worked should imply is simply that the right lodes have not been found yet. In some of the goldfields of Victoria there are dozens of worthless reefs for every one that is payable. Any new discovery should stand on its own merits, and not be judged by the ill success of its predecessors. In fairness to the District it is necessary to make these remarks, as there is a very general impression among the mining public that no gold can by any possibility come out of Gladstone.

Basalts.—These rocks are of no importance in the immediate vicinity of the Gladstone tinfield, but are found to the north-east of it towards the Mussel Roe and the Ringarooma Tier. I have only seen occasional stones indicating the proximity of narrow dykes in one or two other parts of the field, near the head of the Mount Cameron Water race, for example. Their presence is only noted at present because of their probably being contemporaneous with the basaltic flows between Moorina and the Billycock Tier, which overlie the oldest stanniferous gravels.

Gravel Deposits.—It has been stated above that these range in time of deposition from the early Tertiary period to the present time. There are evidences of a long-continued cutting down of the Ringarooma Valley, which has resulted in the formation of successive terraces of gravels varying considerably in their composition, and it appears to me certain that this has been due to an elevation of the land rather than to the simple erosion of the river channel. In order to understand the problem of the modes of deposition of the gravels, it is necessary to leave the immediate neighbourhood of Gladstone, and consider the evidence afforded by the mines at Branxholm, Derby, and Bradshaw's Creek. These have been reported on by Mr. Thureau, F.G.S., in 1884, (see "Report on the Stanniferous Deposits at Ringarooma," No. 99, 1884.) As shown in his map, it is certain that an old channel of the Ringarooma River ran under the basaltic plateau which extends from Derby to David's Creek. Two tributary channels joined it much in the position of the present Cascade River and Main Creek. The mines at Derby afford excellent sections of the whole formation, from which we may note, first, that the bottom of the ancient channel was at least 70 feet below that of the present river, as that depth has been proved by borings in the North Brothers' Home Mine; secondly, that the present river channel cuts across the old beds of the Cascade River and Main Creek; thirdly, that the ancient channels must have slowly filled up with fine quartz gravel, carrying tin ore, till the surface of the gravel stood quite 100 feet above the present river level; fourthly, that the gravel then became covered over with upwards of 200 feet of volcanic ashes and basaltic lava flows; and, lastly, that the existing Ringarooma River has cut its way down through all these deposits and through hard granite rock down to its present position. The river was doubtless diverted from its old course when the ancient channel became filled with streams of basaltic lava, and began to cut a fresh channel through the granite on to which it was forced, and has continued to wear this deeper and deeper ever since. From below the junction with the Main Creek the Ringarooma seems to have abandoned its old course altogether, flowing to the east of Mount Cameron, whereas the old channel lay to the westward of it. The present channel is rock-bound all the way from the Main Creek to below Gladstone, and there is no place where there is any break in the rock showing where it might have rejoined the ancient channel. The Pioneer Mine appears to be either on the edge of the old lead or in a tributary leading into it, but borings here and at David's Creek have proved the bottom of this deep ground to be far below the bottom of the present river, thus agreeing with the borings in the North Brothers' Home in showing that the ancient channel was deeper than the present one. If the old and new channels do not run into one another above Bradshaw's Creek they certainly do not join between there and Mount Cameron, as there is a ridge of granite forming a barrier all the way. The continuation of the rich Brothers' Home lead is therefore to be sought for in the low ground running down past the western side of Mount Cameron, a position in which the general topography of the country of itself indicates that it will be likely to be found. It is well known that there is very deep ground along this line.

Reverting to the sections at Derby, it is clear that, previous to the filling up of the old channel with gravel, there must have been a period when the river was engaged in cutting it out and wearing it deeper and deeper. While this was in progress no large amount of gravel could accumulate in it. The present Ringarooma River has very little fall in it; consequently, when the old river was engaged in cutting its channel, which is so much lower than the present one, it is pretty certain that the general level of the land was much higher than at present. The gradual filling of the channel was most probably the result of a subsidence of the land, causing a reduction of the grade of the river bed and consequent cessation of scour. The subsidence appears to have terminated with the eruption of the basaltic lavas, as the stream again began to cut its way downwards, showing that an elevation of the land had taken place, either with considerable rapidity, or, as is more likely, with a slow gradual movement. During this period of elevation the Ringarooma has excavated its present valley, the various terraces of gravel representing old river flats which have been cut through and left behind by the stream. The elevation of the land must have been accompanied by a recession of the seashore, resulting in the formation of successive beach terraces or raised beaches. These would be cut through by the river in its downward course, so that the terraces of gravel may often be both of river and beach formation, and it could often happen that the higher terraces were beaches while the later lower ones were purely of river origin. The variation in the character of the alluvial deposits at different levels is thus often easily explainable.

The great age of the oldest gravels in the mines at the Brothers' Home is clear from the consideration that a long period of time must be allowed for the gradual filling up of the old channel to the level of the lowest volcanic beds, for the deposition of the latter, and for the subsequent erosion through hard rock of the present Ringarooma Valley. The outflows of basalt in other parts of the colony are considered to have taken place towards the end of the Palæogene period, and there is every reason to believe that those at Derby were contemporaneous with them. No good fossil evidence of age has yet been obtained, for, though leaves were said to have been found in some of the mud-bands passed through in sinking at David's Creek, they were not preserved by the workmen or submitted to any scientific authority for identification. In the workings of the Brothers' Home Mine occasional lumps of old timber, blackened and almost converted into lignite, have been at times found, but the species of wood has not, so far as I know, been determined. Still I think there need be no hesitation in referring the sub-basaltic gravels to the early Tertiary or Palæogene period.

In my recent Report on the Beaconsfield District I referred to the alluvial gravels there, and showed that in the Early Tertiary Period the land stood at least 300 feet higher than now; that it was subsequently to the filling of the Ophir Deep Lead depressed to a level at least 250 feet lower than the present one, and that it has subsequently risen to its present position. These movements of the earth tally with the evidence of the Ringarooma Valley as above described. When, in the Early Tertiary Period, the land stood much higher than now, the Brothers' Home and Ophir Lead channels were being contemporaneously scooped out; then came the great subsidence which piled gravels up to 250 feet above sea level on the slopes of the Cabbage-tree Hill, and caused the old Ringarooma channel to fill up; next came the basaltic flows; and since then a movement of elevation has resulted in the sweeping of the greater part of the accumulated gravels from the Beaconsfield flat, and the erosion of the present Ringarooma Valley. As the bottom of the Ophir Lead is below sea-level it may be assumed that the old Ringarooma lead also runs below sea level towards its outlet. The deposits along its course will, therefore, certainly be very wet and difficult to work.

As it seems certain that the Ringarooma lead must go to the west of Mount Cameron, away from the course of the present river, so it would also appear that the ancient stream corresponding to the modern Great Mussel Roe River ran in a considerably different position from that of the latter. This, at least, is the most probable explantion of another series of ancient alluvial gravels encountered along the course of the Mount Cameron Water-race. On the west side of the race, near the second siphon, there is a somewhat high round hill, apparently entirely composed of small, thoroughly-rounded, granitic quartz gravel. At the foot of this hill the water-race passes through some rather hard cement, composed of rounded quartz gravel also. Several springs towards the base of the hill show where water finds its way out of it. No prospecting, more than sinking one or two small pits, has been done to show if this hill is tin-bearing. It appears to me well worth trying further, as being probably portion of an ancient lead. Further down the Mussel Roe River more deep ground is encountered on F. Whitaker's section, No. 2498-87M, and to the north of it for some considerable distance. Workings on the section named were carried on some time ago, a tail-race having been brought in through soft granite from the Mussel Roe Valley. The granite bottom dips rapidly underfoot at the intake of the tail-race, hence the bottom drift could not be worked. The top drift consisted of sand, granitic quartz gravel well rounded, and well-rounded coarser quartz gravel, all mixed with a good deal of white clay, and containing a fair amount of tin ore. Borings proved a depth of 40 feet below the level of the tail-race without finding any bottom. Some distance north of these workings a deep shaft was sunk some years ago without reaching bottom. Some lignitised wood was obtained in this shaft, but it was all so crumbled that I could make nothing of the few small specimens I was able to find lying about, further than that the wood was thoroughly converted into lignite, showing the deposit to be an old one. This shaft is in a flat. To the north of it there is a gravel hill, which slopes down to the Mussel Roe River. Several springs occur on its northward slope, and I was informed by Mr. Richards, who has done much prospecting in this district, that at the foot of the hill in the bed of the Mussel Roe the ground appeared to be very soft and deep, as he could thrust a long pole a great way down into it, evidently through gravel. It would seem from this that the old lead which evidently exists in this locality crossed the Mussel Roe and went more to the north-west, a course which would connect these gravels with some other ancient deposits to be mentioned presently. I had only time for a flying visit to this part of the field, and was not able to examine it so closely as it deserves, but it seems extremely likely that there is a deep lead running through it, and very possibly connected with the hill near No. 2 siphon above mentioned. From its soft nature this deep ground is extremely difficult to prospect, but the tin ore got in the upper parts of the drift in Whitaker's workings gives good ground for believing that in the gutter of the lead very good tin ore will be found. By driving in from the northward, where the Mussel Roe crosses the lead, it is probable that the ground could be well tested. Should it prove payable an ample supply of water for working is close at hand in the Mount Cameron Water-race. This neglected part of the field is worthy of attention from men who are disposed to risk some money in the necessary, somewhat expensive, prospecting. It is beyond the resources of working miners to develop without capital to assist them, and this, I think, is what has led to its lying idle so long.

The course of this old lead after crossing the Mussel Roe is not clearly traceable, being often broken by erosion of more modern valleys, and overlaid by more recent deposits. A number of deposits of cement, however, extending from the Mussel Roe to the Aberfoyle country may, perhaps, be portions of it, though perhaps of later and marine origin. My reason for connecting them with the Mussel Roe Deep Lead is that the cement is made up of rounded granitic quartz particles similar to those of the gravels of Whitaker's workings. Further, there is reason, as we shall see, to believe that these cements are considerably older than the other gravels of the district. The cement is a rather hard conglomerate, sometimes very hard and solid, and not unlike granite in appearance; it is often mistaken locally for bedrock, and called quartz porphyry, but may be easily distinguished from the crystalline rocks by the well-rounded character of its constituent pebbles. It forms the small hill sometimes called the Edina Sugarloaf, and is also found to the north-east of it under the long siphon of the Mount Cameron Water-race, near Ogilvie's dam (58-87w.) About two miles north of the long siphon along the Water-race the latter leaves the cement or conglomerate formation and runs over slate and sandstone bed rock—(I prefer to use the name "cement" instead of the more strictly scientific "conglomerate," as the former name is better understood by miners as being wash or gravel converted into stone by some binding material.) To the north, or north-west rather, of the point where the Water-race leaves the cement I have not seen the latter for a long distance—not till the Aberfoyle country is reached, where the Brown Hill, near Tea-tree Lagoon, is again composed of it, and also some low hills north-west from the Mount Cameron Water-race Storage Reservoir (80-87w.), generally known as Matthewson's Lagoon. Between the Edina Sugarloaf and the Brown Hill there is a line of very deep ground, as to the nature of which I am in considerable doubt, whether to refer it to the same formation as the cement or to a later one. This deep ground, strangely enough, lies on the watershed between the Ringarooma and Mussel Roe Rivers, in the northern portion at any rate. The northern extension of the Mount Cameron Water-race, from about half a mile north of the crossing of the Cape Portland road, all lies upon this deep ground, which here seems to be over a mile in width. Numerous shafts have been sunk in a fine white gravel drift, some as deep as 70 feet without reaching the bottom. The character of the gravel—fine water-worn quartz pebbles derived from degradation of granite—points to a connection between this deep ground and that higher up the Mussel Roe. There is a break in the continuity of the deep ground where the road from Bell's Bridge to Cape Portland runs across its course. I have not been able to detect any sign of an old deep lead crossing this road, and it would seem that the valley of the Pig-and-Whistle Creek has cut right down through it; if so, the bottom of the lead above this road will be above the level of the Ringarooma River, and therefore capable of drainage into it. To the south-east of this blank space deep ground is again found in the old Tamar and Garfield Companies' workings, and extending from thence to the cement near the Edina Sugarloaf. I am inclined to believe that the line of deep ground thus traced between the Edina Sugarloaf and the Brown Hill does represent the general course of an old lead, but that the upper portions of the gravels have been greatly disturbed since their first deposition. The lead, if there ever was one, was the channel of an older Mussel Roe River, cut out when the land was at a higher level than now, and filled when the subsidence took place which filled also the old Ringarooma lead. This subsidence probably brought the sea in over all the country just described, causing a re-distribution and re-arrangement of the surface gravels, though not likely to have affected the lower deposits in the gutter. While the sea was again receding in the subsequent period of elevation further re-arrangement of the surface gravels would result. The existence of the Edina Sugarloaf and the Brown Hills as hills shows that they were once parts of a much more extensive deposit, which has been greatly worn away, leaving these harder portions standing out. This wearing away in all probability took place partly during the encroachment and retrogression of the sea, and partly owing to ordinary sub-aerial agencies afterwards.

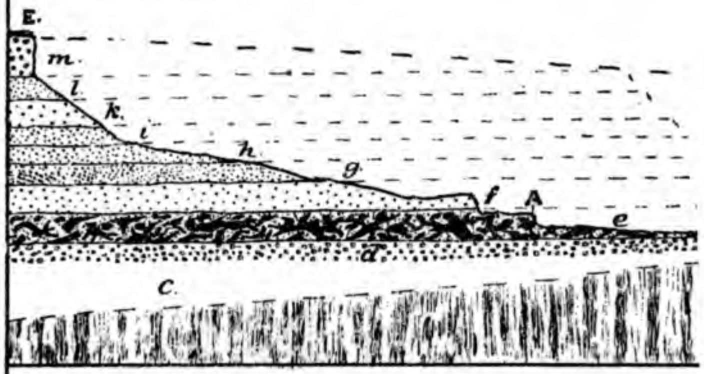
There are several things which point to the presence of the sea over these deep gravels. For example, the cuttings for the northern extension of the Government race are nearly all in a brown, somewhat ferruginous, cemented sand, often clayey. Nodules of oxide of iron, containing sand, and loose white sand, are pretty common. The sand is such as is found by the sea shore, and the cement might well have been formed in a shallow lagoon behind sandhills fringing the sea shore, as is so commonly seen along our coasts at the present day. Whether laid down in exactly this way or not, the sand shows that the sea was probably close at hand when it was deposited. In the old Martha and Tamar claims deposits of what appear to be sea sand are also found, and in the latter, more especially, there is evidence of lagoon deposition. Two sections through the workings of the old Tamar claim are appended hereto. Towards the northern and north-western end of the workings the Silurian bedrock is visible, dipping rapidly to the south east. On this lay heavy gravel, consisting of rounded and sub-angular small boulders and stones of sandstone, quartz, and dark chalcedony, the sandstone of the bedrock predominating. The chalcedony is identical with the material in a well defined lode or vein of it found on the old Eureka claim, across Harden's Ravine from the Tamar. A few stones of quartz-porphyry similar to that in Mallinson's dyke also occur, and to further show that this gravel is partly derived from adjacent granite bedrock crystals of black quartz are not uncommon. All this heavy wash has now been sluiced away, and its relation to the sands composing the walls of the excavation is not therefore so clear as if it could be seen *in situ*, but it is nearly certain that it is of later origin than the latter, and I think represents a place where the old deep ground was subsequently cut away by water action and replaced by later gravels. On working more to the south east the heavy gravel gave out, and in its stead layers of sand were encountered, which were found to surround the gravel except on the northern side, where the hillside falls away. The walls of the excavation are now all composed of sand. The layers are sometimes cemented by oxide of iron, and often contain hard cakes of oxide of iron. In parts there is a good deal of clay. Much carbonaceous matter is found through the sands; but though I searched for a long time I was unsuccessful in getting any leaves, by which the age of the deposit might be estimated. In the bottom of the present face lies a layer about 8 feet in thickness, mainly composed of fragments of timber, partly and sometimes wholly converted into lignite. Some of the wood is very little altered, and still splits freely. The fragments of timber seem to be mostly roots, logs, and pieces of heavy branches—ordinary drift-wood, in fact. They are mixed up with sand and mud and a little fine gravel. Concretions of iron pyrites are often found on the wood, and occasionally partly replace its substance. The wood has not yet been microscopically examined, but seems almost certainly that of a species of pine. In other parts of the colony, as at Breadalbane and Corra Lynn, fossil wood and lignite are found consisting mainly of coniferous tree remains, and it would seem that in Early Tertiary times members of the pine family were the commonest forest trees. The coniferous woods of this deposit themselves therefore point to its belonging to the oldest alluvial gravels, and give ground for believing that I am right in connecting this with a Palæogene Mussel Roe lead contemporaneous with the Ringarooma deep lead. This belief is substantiated further by the fact of more recent, but still old, gravel having been deposited in an eroded portion of the sand deposit as above described, and by the apparent connection of the Tamar workings by deep ground with those of the Garfield, and on to the cements of the Edina Sugarloaf. Not that I think that the Tamar sand beds were laid down by river action in the old Mussel Roe channel, but rather that they are among the very highest beds of the filling of it deposited when this part of the country was almost at sea level, and the old channel formed a shallow estuary or lagoon. The layer of drift-wood; the sharp sea sand; the prevalence of ferruginous and carbonaceous stains; the false bedding often seen in the sand,—all point to an estuarine or lagoon formation. Above the sand beds there is a layer about 11 feet thick of fine quartz gravel, which most probably indicates a further advance inland of the sea, and complete submergence of the lagoon deposits.

The old Martha workings in one place show a face about 20 feet deep, composed of very small quartz gravel and sand, the latter fine sea-sand as in the Tamar claim. The bottom bedrock is dipping away from the Ringarooma Valley, more towards that of the Pig-and-Whistle Creek. As these beds of sand in the Martha are quite 60 feet lower than the similar ones in the Tamar, they are not likely to belong to the same horizon, but they also give evidence of the former presence of the sea running up much along the line of the supposed Mussel Roe lead.

The sands in the old Tamar mine were found to contain a little extremely fine tin ore, which, though not itself nearly payable, bears witness to the presence of tin in the rivers running into the sea at the time of its deposition, and thus gives promise of better results when the true river channels are discovered.

The deep gravel and sand formation extends from the Tamar workings, round the head of Harden's Ravine, to the old Garfield Company's workings on Section 2077-87M. These, again, are connected by a spur which appears to be entirely composed of fine quartz gravel with the high-level dam of the Esk Com-

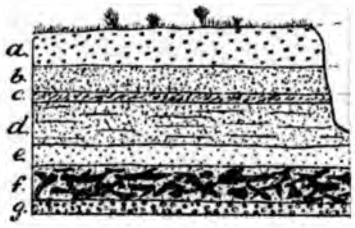
SCALE.



LONGITUDINAL SECTIO

THROUGH THE OLD

a. Silurian bed-rock. b. More ground. d. Bed of small gravel. gravel, somewhat cemented. f. g. h. i. clayey, sand.

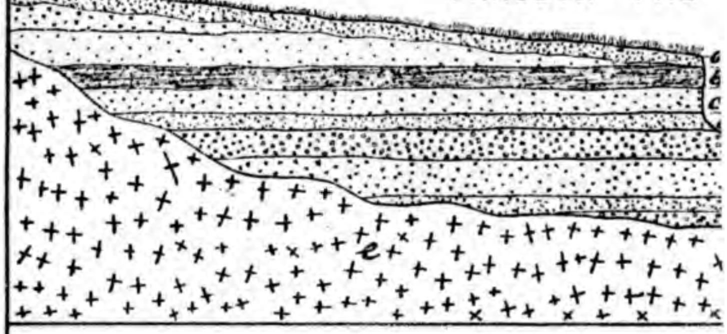


CROSS SECTION

a. Cemented rounded fine quartz grave oxide of iron. c. Clayey whitish sand, in cemented with oxide of iron, with numerous cemented at all, but is simply loose sand. f. Lignite mixed with sand, mud, and grav

C

THROUGH THE



a - Surface cement crust. b. Cla and coarse sand. d. Heavy wash,

pany. The excavations for this show no bedrock, but only fine rounded quartz gravel and yellowish-brown sandy clay. A somewhat large cutting between this and the Eureka dam shows the Silurian bedrock not far from the surface, and south of the Esk dam solid granite crops out, so that in this part there does not appear to be a great depth of gravel. The cutting shows the following section in the face:—

	Feet.
Surface soil and ferruginous cemented clayey fine gravel of rounded quartz pebbles and granitic quartz grit	3
Very clayey layer, containing gravel	2
Coarse brown sand, sometimes false-bedded, with occasional small gravel in horizontal layers	11
Coarse gravel of sub-angular fragments of the Silurian bedrock and angular and sub-angular quartz	1
Silurian slate and sandstone bottom.	

The coarse gravel resting on the bottom seems to have formed only a very small proportion of the whole mass, and to have been immediately derived from the bedrock below, though a few stones from lodes in the granite and black crystals show that part of it was transported from neighbouring granite bottom. The Silurian bedrock is again seen in a cutting at the back of the Eureka dam. Between the Garfield and Tamar claims, however, numerous shafts have been sunk without reaching bottom, generally not to greater depths than from 20 to 40 feet on account of the soft running nature of the fine gravel and sand passed through, which was often regular quicksand. In the eastern side of the Garfield workings the Silurian bedrock is visible, but towards the outlet the ground has not been bottomed, and large quantities of sand are encountered. It seems likely, therefore, that the deepest ground lies east of the Tamar and west of the Garfield cuttings. The average depth of the latter is from 6 feet to 16 feet. The following section was observed as a representative one, in one of the faces:—

	Feet.
Surface soil	1
Ferruginous cemented sand	1
Fine well-rounded gravel, with one bed of coarser gravel near the middle of the layer	7
Small very well waterworn quartz and quartzite gravel, with softened slate fragments and stones of Silurian sandstone	2½
Coarse sand and fine gravel, rather cemented, not bottomed	3

The beds of fine gravel and sand make and thin out again in short distances. The beds of sand often show false bedding. The Garfield workings are about 40 feet higher than the top of the Tamar face. These gravels were doubtless laid down when further subsidence of the land had sunk the Tamar beds well under water and brought the sea further up the old river valley.

It will be seen from the above that neither the Tamar nor the Garfield workings give direct evidence of belonging to the same formation as the cements of the Edina Sugar-loaf and the Brown Hill, but they go to show that deep ground exists along the line connecting these places, and that this deep ground was filled by the advance of the sea inland, which must have been at its furthest when the basalts of the Brothers' Home were being poured out. Should the reference of the cement deposits to an old Mussel Roe River bed be correct, it is clear that the river valley would be the most favourable place for the accumulation of deep masses of gravel during the advance of the sea, hence it is somewhere under these marine gravels that we should look for the ancient river deposits. The theory has enough plausibility in it at any rate to be worth testing by borings, though these would be difficult of execution on account of the quicksands.

The deep ground between the Pig-and-Whistle Creek and the Aberfoyle would, probably, be the lower part of the old Mussel Roe Valley, but mostly filled with marine gravels. The old river channel, with its probably richer gravels, is, most likely, covered to a very considerable depth. The shafts sunk in this part of the district have nearly all gone through a succession of fine quartz gravel and sand beds poor in tin. If my theory of these being the ancient river gravels, washed over and over again by marine action, is correct, very little tin could be expected in them until the deeper unmoved river deposits are reached. These, also, it might be presumed, would not be so rich as higher up in the leads nearer to the granite formation. Beyond noting the ferruginous clayey sands found in the northern extension of the Mount Cameron water-race as of probable estuarine or lagoon formation, as above mentioned, I have not been able to get much evidence about the deep ground in this lower part of the old valley. The Lochaber workings possibly belong to this formation. The upper beds are very like those of the Tamar, and the bottom appears to be getting deeper towards the north west, thus sloping towards the main area of deep ground. The following section was noted in these workings:—

	feet.
Soil and cemented gravel	2
Sand, very fine gravel, and clay	15
Rather fine quartz gravel	10
Coarse angular sandstone and quartz stones and gravel	5
Brown cemented fine gravel	10
Bottom of Silurian slate.	

These workings have produced very fair tin, mostly from the heavier lower wash. This often contains somewhat large quartz boulders and pieces of waterworn quartz porphyry. The upper beds are in horizontal layers. The pebbles are mostly of quartz, but some of Silurian sandstones and of quartzite. Black quartz crystals are not uncommon. As these workings lie very low down, the outlet of the tail-race being not more than, perhaps, fifteen feet above the Ringarooma River, it seems possible that they are approaching much nearer to the old lead, which may account for their much greater richness in tin as compared with the higher Tamar and Garfield gravels. I am inclined to refer the Lochaber deposits, however, rather to the marine series than to the true river gravels of the old lead.

If the sea had once covered all the Gladstone district to a height above the Esk dam, as assumed in the foregoing, it would, probably, have left traces of its presence in other parts than those mentioned. It may be said at once that no shells or purely marine organisms have been found to clearly prove the former presence of the sea, but when we consider that most of the deposits preserved were originally shifting sands and gravels, and that these are generally very poor in organic remains, and that only small patches of the marine beds have yet been laid open to view, it is not at all surprising that shells have not been found. Other evidence is, nevertheless, available. This is best obtained in the terraces on the north slope of Mount Cameron. These are completely cut off from the Ringarooma Valley by high spurs of granite running down from the mountain, so that they cannot have been laid down by the river even when at a much higher level. The Mount Cameron Company's claim, and those of Mr. L. Petersen, afford information as to these terraces. The longest and largest one is that in which Petersen's principal workings are situated. It extends right along the foot of Mount Cameron for over two miles, about parallel to the range, and may be located on the map of the district by the water-races running along it. The top of this terrace preserves a pretty uniform level of about 90 feet above the township of Gladstone. There are, however, remains of two still higher terraces—one near the middle of Section 916, 130 feet above Gladstone, and the other, a small patch only, about six chains S. 5° W. from Wilson and Petersen's old dam (W.R., 45), 190 feet above Gladstone. As the township is about 270 feet above the sea, gravels are, therefore, found on the slopes of Mount Cameron to a height of 460 feet. The character of the terrace gravel is considerably different from that of the modern river gravel, and would itself indicate a marine origin as more probable than a fluviatile one. The pebbles consist mostly of hard quartz, thoroughly rounded and polished by long continued attrition, and generally rather egg-shaped than in the flattened disks most common in river gravels. Besides the quartz there is often in some of the terraces a considerable amount of quartzite derived from the old Archæan rocks, which is a very ancient metamorphic sandstone now often sub-transparent, but still showing the constituent grains and stratification planes. Wherever this is found it is most thoroughly waterworn. It is a very hard stone, and must have required an immense amount of rolling about to wear it into the shapes found. This rock does not occur in the newer river gravels, except in very small quantity, and even when it is found it is so much more thoroughly polished than the rest of the gravel that it is plainly derived from older gravels which have been washed down into the river bed. The successive terraces from the highest down to the present river level are characterised by a marked diminution going downwards of the percentage of quartzite in the gravels. The highest terraces contain the largest proportion of it, and the least of gravel such as is now being brought down by the river. As it does not appear to be brought down at the present time by the Ringarooma, it is improbable that the quartzite occurs *in situ* anywhere up its valley, and if so the occurrence of it in the higher terraces must be attributed to some other source than the river. Exactly similar quartzite is found in the old gravel deposits which are met with at intervals along the road from Scottsdale to Moorina, in some also near Lilydale, and on the top of the Sandhill, near Launceston. All these old gravels doubtless are remains from the time when the land was much lower, and the sea beach reached to points now far inland. The quartzite pebbles have been derived from the Archæan conglomerates and quartzites found at places along the north coast of the Island, and spread all along the beaches by the action of the waves.

It is noteworthy that the beach terraces on the north slope of Mount Cameron are much more free from these pebbles than the other high marine terraces up the Ringarooma Valley. This is most likely due to the high granite spurs which separate these localities. These spurs would form capes round which the drift beach gravel could not easily pass. Petersen's workings show the wash of the North Mount Cameron terraces to be composed almost entirely of *débris* from the granite of the mountain, fine quartz gravel and sand, coarse heavy lumps of vein quartz, and crystals of black quartz. The heavy gravel on the granite bottom is often not much waterworn, while the higher lighter gravels show extreme attrition. As there are no large streams on the north slope of the mountain to round these gravels, we must conclude that their shape is due to ceaseless washing backwards and forwards on the sea beach. The beds of gravel lie fairly horizontal, but generally slope slightly seaward. The granite bottom confirms the view of the beach formation of these terraces, being uneven but not furrowed into regular gutters as when cut out by running streams, and sloping gently seaward. The bottom when stripped shows much the appearance presented by a flat granitic beach of the present day. The distribution of the tin ore is in accordance with this theory, being in flat layers through the drift, and not concentrated in the furrows of the bottom; indeed, these have been found to be so generally poor that they are often not cleaned out in working. The beach being a natural buddle has served to concentrate the tin ore just as black iron sand is often seen concentrated on our coasts at the present time, and the layers of ore thus formed have become covered with further deposits of gravel, and so preserved. A very similar occurrence is seen in the black sand beach-leads of the West Coast of New Zealand, where layers of black iron sand containing gold are worked in what is without any doubt an old beach formation, and on the beach at Charleston and elsewhere "beach-combers" make a living by working similar beds forming at the present day.

Taking a line northward from Petersen's main workings it is found that a succession of terraces parallel to the large one, and at successively lower levels, extend seaward for some distance. Between each terrace and the next lower one the granite bottom often crops out. Some of the layers of gravel are very shallow, and none seem to be very deep. These terraces represent successive stages in the retrogression of the sea-shore.

I have dwelt at length on the facts which prove that the sea was at one time washing the flanks of Mount Cameron and extending far up the Ringarooma Valley, because this is the key to the problem of the manner of formation of all the terrace gravels right up the latter. It is easy now to understand that as the land rose and the sea receded terrace after terrace of gravel was left behind. These have since been so cut away by the water running over the surface that only fragments of them now remain. The highest terraces were probably of purely beach formation, but as the sea retired the waters of the Ringarooma began to carve into the ground, and the lower terraces are in most instances of river origin. As above pointed out, the percentage of quartzite in the gravel gives a clue to its origin, whether beach or river.

In consequence of their mode of deposition we should expect to find somewhat similar gravels at the same elevation above sea level. I append a table of heights of various points in the district noted by me with an aneroid barometer, which shows approximately which deposits are at or about one level. The newer river terraces can of course only be correlated by taking the fall of the river into account as well as the absolute elevation. As a matter of fact the various gravel deposits do agree with considerable exactness with those at corresponding levels elsewhere through the district, thus substantiating the theory of their formation above advanced. We may now classify the gravels as follows :—

(I.) *Palæogene.*—A. *Older River Gravels,* including cements of Edina, Sugarloaf, and Brown Hills.
B. *Newer Marine Deposits*—Tamar, Garfield, and Lochaber claims.
(II.) *Neogene.*—A. *Older Beach Gravels*—Petersen's terrace, Mount Cameron Company's terrace, Colossus terrace, Enterprise terrace.
B. *Mixed Beach and River Gravels*—Scotia, Aberfoyle, and Gladstone terraces.
C. *River Gravels*—Simpson's terraces at South Mount Cameron, lowest terraces in the neighbourhood of the Ringarooma River.

1. *Palæogene*—A *and* B, *Older and Newer River and Marine Gravels.*—These already have been considered at length, and need not be now reverted to. They are the filling of the old Mussel Roe lead as first laid down by the river and afterwards by the sea. One point of some importance has not yet been mentioned, namely, that boulders of the cement or conglomerate frequently occur in the later gravels of the Neogene period, showing that the old wash had been already hardened and subjected to erosion when the latter were being laid down. The much greater antiquity of the cement is, therefore, evident. I have observed boulders of the old cement in some workings up Smith's Creek at South Mount Cameron, some distance above Mr. John Simpson's house, in J. W. Brown's old workings near Ogilvie's Bridge, in Ogilvie's Edina claim, in the Scotia Company's workings, and in Nobes's claim at the Aberfoyle, and was informed that it was frequently met with in other claims. In these workings it is a very hard conglomerate, composed of small rounded quartz pebbles, cemented by a siliceous cement into a very solid stone, which rings when struck, and breaks with a flinty fracture. In Brown's and the Edina claims it is found in large tabular masses, sometimes five or six feet square and one to two feet thick, resting loosely on the granite bedrock, but surrounded and sometimes underlaid by the gravel. Most of these large tables are smooth and polished on the upper surface, and have been considerably worn there by water. The polished surfaces appear to have received more of the siliceous cementing material than the rest of the mass, and often there is a sort of thin transparent siliceous skin or gloss on the surface. The appearance is such as would result from the passage of a solution carrying dissolved silica over fine quartz gravel, loose or somewhat cemented. The solution would at first penetrate freely into the porous stone, and so cement the particles strongly together, but as, owing to this action, the mass would become denser, and less easily penetrated, after a time only the surface layers would be permeated by the solution, and finally it would flow over the surface without going into the now hard rock at all. It is difficult to imagine how these large flat angular blocks of conglomerate could have been moved far from where they were formed, and I incline to the opinion that near Ogilvie's Bridge they are almost *in situ,* and are fragments showing that the old cement formation was once much more extensive. In the Scotia claim the pieces seen were much waterworn, and had probably been transported a long way from their original position.

II. *Neogene*—A. *Older Beach Gravels, Mount Cameron Company's Section, No.* 100.—On this ground a considerable patch of wash belonging to the older beach gravels has been worked out with payable results. It formed a shallow capping, not probably more than 10 feet deep anywhere, on the top of a ridge between the Fly-by-Night Creek and a small branch of the Mount Cameron Creek. The bottom is of slate, much decomposed to clay in the upper portions. Tin ore was often found in these upper clays, evidently having sunk down slowly into them, just as gold has often been found in the pipeclay (decomposed slate) bottom of many Victorian gravel deposits. All the tin ore obtained in this claim was extremely waterworn. The slate bottom is rather uneven, but flattish on the whole, and shows no true gutters eroded by running water. The wash lies in horizontal layers, and is composed of somewhat angular and subangular pieces of quartz and Silurian sandstone, with some well-rounded pebbles of quartz and quartzite. There are also occasionally rounded boulders of a brecciated rock, consisting of angular fragments of Silurian bedrock, cemented by black and white chalcedonic quartz. This may perhaps be of contemporaneous origin with the conglomerates of the Edina workings. On the whole the heavier material of this terrace appears to have been derived chiefly from the bedrock upon which the gravel rests, and not to have travelled very far. A good deal of coarse sand and fine gravel occurs enclosing the heavier stuff. The deposit is covered with a somewhat ferruginous hard cement which has protected it very much from erosion. Below the principal workings in the small creek the bedrock changes to granite, and at the contact of this with the sandstone and slate formation there is a small lode of silicified granitic matter, about three feet wide. Stones from this or a similar lode are found at times among the wash. It may be mentioned that the gravels of this claim contained a good deal of gold, as well as tin ore. The main body of gravel has all been worked over, and at the time of my visit the only mining going on was being done by Chinese, who were stripping the surface soil and putting it through sluices. Under this soil patches of cement were occasionally visible, and there is a possibility that on breaking through some of these some heavier gravel left in depressions of the bedrock may be found, though there does not seem to be much hope of getting any extensive patches.

At the easternmost corner of this section, and on that known as the Fly-by-night claim (1130M) adjacent to it, there is rather a thick deposit of hard ferruginous cemented sand and fine gravel, from two to four feet thick. Some of it is very black, as if originally formed in a swamp or lagoon. Under it lies a little quartz wash containing tin. The cement itself contains tin, but would require crushing, as it is too hard to be broken up in the sluices. Several small holes have been sunk through the cement here and there, and one considerable excavation has been made, but it has not been considered worth working. It is probable that if a series of trenches were run through the cement several underlying patches of gravel would be discovered.

Petersen's Claim (Section 823).—A very large excavation has here been made in a part of the long beach terrace formerly mentioned. The bedrock is granite, lying pretty flat, but with a slight slope seawards. The wash is mostly well water-worn small quartz gravel, with coarser subangular pieces of quartz on the bottom, all evidently derived from granite rock. The following section of one of the faces was noted:—

Fine gravel, somewhat cemented with clayey and ferruginous matter...	7 feet
Fine quartz gravel, a little cemented, white in colour, showing false bedding..	5 feet
White clayey sand..	½ foot
Wash in nearly horizontal layers of fine and somewhat coarse quartz gravel..	12 feet
Heavy subangular quartz stones...	½ foot
Granite bottom.	

This has the reputation of having been a very profitable claim, and the large extent of the workings all made by one man pretty conclusively prove that such has been the case. Tin is easily seen in many places in the wash. Lying rather high up on the mountain there is difficulty in getting constant supplies of water for working. Could a copious and never-failing supply of water at high pressure be brought on to this ground it ought to pay remarkably well. This claim may be taken as proving the general value of the long terrace lying to the westward from it, on which very little work has been done for want of water. Several test shafts have been sunk at intervals along this terrace, and very satisfactory proof obtained of there being both quantity and quality of tin-bearing gravel.

The higher terraces above mentioned are of small extent, but are said to be worth working when water can be obtained for them, which is but very seldom.

The lower terraces running parallel to the main one are of considerable extent, and some work has been done on parts of them with fairly payable results. A considerable excavation has been made on the boundary between Sections 1047M and 2286–87M, about 2¼ chains south-east from the westernmost corner of the former. The face presents the following section:—

	Feet	inches.
Surface soil and white sand like sea sand..	1	6
Ferruginous and clayey cemented coarse quartz sand................................	4	0
Tough white clay with much sand in it..	4	0
Wash, quartz gravel with good tin, finer towards the top, coarser towards the bottom of the layer..	1	6
False bottom of clayey sand, which changes to gravel in parts of the same horizontal layer..	1	0
Layers of finer and coarser quartz gravel with a little sandstone, and lenticular clayey sand patches..	8	0
Granite bottom.		

In this opening a junction of the granite and Silurian formations is seen, the latter slightly overlying the former. Very fair tin has been obtained, and there appears to be a large quantity of gravel ahead to be mined.

It appears to me that these beach terraces along the north slope of Mount Cameron are among the most important gravels in the district. There is a large extent of unworked ground which has given good prospects, and when water can be got a large amount of tin ore will probably be obtained. The obstacle which has prevented their being worked is that all the available water supplies have been secured by the Mount Cameron Company, the owners of the Fly-by-Night claim, Petersen, and one or two others, who require all that they can get for their own claims.

Enterprise Claim (Section 128.)—A shallow patch of ancient wash forms the top of a flat-rounded small hill on this section. The workings cover a large area, but are of small depth. The wash is composed of well rounded gravel, mostly quartz, but also in part quartzite. The bottom rock is granite. On the top of the hill I did not see the bottom, and am not certain if the workings have reached the bedrock. There appears to be a considerable amount of gravel yet to be worked, but the top ground being very high there is difficulty in getting water on to it. The claim has been very rich in the past.

Colossus Claim, South Mount Cameron.—I am inclined to class the gravels of this claim with the beach deposits on account of their occurring in a large flat even layer rather than in leads or channels, and from the gravel being mostly composed of very well-rounded quartz pebbles with only a few of hard sandstone. The same sort of gravel is found at intervals along the road from South Mount Cameron to Gladstone at much the same height as the Colossus terrace, so that the deposit must have covered a very considerable area. The Colossus Company have opened several excavations in the gravel, working it by means of water pumped from the Ringarooma River. I do not think that the ground will pay for mining so long as water has to be thus so expensively obtained. The results of working up to date are not encouraging. Owing to the flatness of the bedrock on which the gravel rests, difficulty will be experienced in getting in tail-races as the work of stripping proceeds.

B. *Mixed Beach and River Gravels.*—These deposits are characterised by containing a varying proportion of flattened shingle derived from the river, and were probably laid down on beaches in an estuary at the mouth of the river. They are intermediate between the purely beach deposits and the true river terraces. The majority of the gravels close to Gladstone township belong to this class. They lie in fairly horizontal layers on comparatively flat but uneven bottoms, which do not, as a rule, show well defined stream channels, and which, therefore, appear more likely to have been cut into their shape by marine than by river action. A section from the township of Gladstone to Bell's Bridge would show a succession of steplike layers or terraces of gravel with the bedrock cropping out between each pair. None of the layers of gravel appear to be very deep, ranging from three or four feet up to ten or twelve feet on an average, though sometimes as deep as thirty feet. A well in the yard of the *Gladstone Hotel* is said to have gone through thirty feet of wash. None of the highest gravels appear to have been thought worth working, though numerous prospect holes have been sunk. These top terraces are largely composed of small well-rounded quartz and quartzite pebbles, with a good deal of clay and sand. The highest workings close to the township are those on Butler's section, on the slope towards the Mount Cameron Creek. At the time of my visit a start had been made here, and an excavation about 12 feet deep worked out. There was a good deal of coarse gravel in the face, covered by a layer of finer gravel mixed with clay. The first clean-up was disappointing, not being payable. Whether the ground will improve remains to be seen.

The next terrace that has been worked is what is known as the Syndicate's claim, belonging to Messrs. Carlinn, M'Kimmie, and Matthewson. Here a great deal of work has been done with, I understand, payable results. The wash has been of an average depth of from 10 to 15 feet, the bottom being very uneven. There is a top layer from 2 to 3 feet thick of ferruginous cement, composed of fine quartz gravel well rounded. Below this comes the wash consisting of layers of finer and coarser well rounded quartz, quartzites, and jasper gravel. In the bottom layer there is a good deal of broken Silurian bedrock, and sub-angular quartz. The next terrace below the Syndicate's claim is that in which the workings of E. R. Groves, T. Morrissey, and Jas. Ogilvie (now, however, part of the Syndicate's claim) are situated. There are considerable depths of gravel in this terrace, which has proved to carry tin rather unevenly, some of the workings being payable and others poor. There is yet much untried ground in this terrace, and it will, no doubt, all be worked in time. Ogilvie's face is about 18 feet deep. There is a top layer of three feet of brown quartz-grit cement, then a succession of layers of finer and coarser gravels lying fairly horizontal. Quartz and quartzite make up the bulk of the pebbles in the upper drift, but near the bottom there is a good deal of rounded and sub-angular Silurian fragments from the bedrock and quartz from the veins in it.

On the Mussel Roe Road, north of Ogilvie's Bridge, there are two large terrace-workings, executed by C. A. Ogilvie and J. W. Brown respectively. A little to the north of Ogilvie's workings there are some gravels seen on the roadside that may belong to the older and higher Enterprise terrace. In Ogilvie's workings the wash averages about 10 feet in depth, and is overlaid by from 4 to 6 feet of sandy clay. It consists of thinnish horizontal layers of quarts, quartzite, and metamorphic slate and sandstone gravel of rather small size interspersed with granitic grit or coarse sand. The deepest part of the ground is furthest away from the outlet, and a new tailrace has had to be brought in in order to get fall to work with. This deposit is reported to have given payable returns, and extends over a large area, so that there will be work for a long time in sluicing it away. It may possibly be connected directly with the Enterprise gravels, though I believe it is a lower terrace.

The granite bedrock crops out between these workings of Ogilvie's and J. W. Brown's, which latter lie just north of Ogilvie's Bridge. The cutting is from 30 to 40 feet deep in the deepest parts. The wash is coarser than in Ogilvie's face, and the river gravels predominate over the beach quartz and quartzites. Indeed, this deposit might be as well classed with the river gravels proper as with the present division. The large blocks of cement found here have been already mentioned. These workings have been abandoned and the ground given up, so it may be presumed that it was unprofitable. This is unfortunate, as there is still a large quantity of gravel in this terrace if it could be made to pay.

Lower down the river, and on the east side of it, is James Ogilvie's Edina claim (section 1251M). Both in height and in the character of the gravels in it, this corresponds very well with the terrace worked by C. Ogilvie above described.

Mention should not be omitted of the old Empress claim in the list of gravels of this division. The workings are situated on sections 677 and 164, and run nearly due north across a ridge separating Harden's Ravine from the low country east of Bell's Bridge. Forming a gulch as they do at right angles to the course of the spur, they afford a striking example of the difference in the course of the present and ancient streams. The gravels were laid down in a saddle between two granite hills, and have been cut away on each side by the modern watercourses, until only a small portion is left as a ridge filling the old saddle. There is said to have been a sort of channel or gutter along which the workings were carried, but it must have been quite a shallow one, for the gutter now seen has evidently been cut out by sluicing, and the beds of wash run off nearly horizontally in layers on each side. A cross-section of the workings is given to show this. On the west side the surface shows gravel for about 10 or 12 chains, right to the old fluming on the top of the hill from which the pipes for the Tamar workings were led. On the east side the granite crops out about 4 chains from the cutting. It appears to me that this ground has been abandoned too soon: for though the bottom doubtless rises on both sides, on the western side there is room for other gutters like the one worked, and the total quantity of gravel left untouched must still be very large. It may have been prospected, but I saw no traces of the pits if there were any. The wash is in horizontal layers; the heavy rich gravel having been in the shallow channel aforesaid. That which now composes the walls of the cutting is nearly all fine gravel and coarse granitic sand. The gravel is well-rounded quartz for the most part, and the sand shows false-bedding frequently.

The claims on the Scotia terrace also appear to have been formed by the joint action of sea and river rather than by either separately. The gravel is composed of about equal proportions of quartz, quartzite, and Silurian sandstone, all much rounded. The workings average 10 to 15 feet in depth. On the bottom (Silurian) there is coarse gravel with a good deal of subangular quartz. The bedrock bottom runs very flat and without definite water channels, and slopes gently to the north-west. The wash is overlaid by 4 feet of sandy clay and 2 feet of surface cement. The Scotia Company and J. W. Brown have opened six faces in this terrace with payable results. The terrace is very extensive, and should give work for many years to come. The flatness of the bottom and consequent trouble in getting fall for the tail-races is the principal drawback to future success.

Further down the river we come to the sections held by the Aberfoyle Company, Messrs. G. B. B. Elliott, Nobes, and others, on an extensive area of gravel generally spoken of as the Aberfoyle country. The bedrock here is granite. The wash is, as a rule, much smaller than at the Scotia, but otherwise very similar, and has decidedly more the appearance of beach gravel than of river. Most likely these deposits were laid down at the mouth of the river where it debouched upon a wide flat beach. They are generally not very deep where opened by working. The tin obtained in this part of the district has been very patchy, and on the whole the ground does not appear to be very rich, though good enough to ensure being worked. Like all alluvial ground where there is large quantity of somewhat poor gravel, this should be worked with a copious supply of water so as to move the stuff rapidly. There appears to be a disposition on the part of owners to economise by using little water and that of low pressure, but all sluicing experience has gone to show that this is false economy, and that it pays to use much water and the greatest available pressure, even though the first cost of pipes to bring in a high pressure supply is very considerable. Another direction in which it appears to me that much money and labour are lost is in the bad location of tail-races. All over the field numbers of expensive tail-races are seen, now out of use, and superseded by others still more expensive. Numbers of pits should be sunk all over the ground to be worked so as to ascertain the shape of the bottom, and the trail-races should be designed in the first instance to command the whole of the deposit, either from the first, or with comparatively small expense from time to time in deepening them. At present they seem to be taken in, in a very happy-go-lucky style, without any system.

The workings on Nobes's Section, at the Aberfoyle, show a very interesting section, which, as work proceeds, will very likely throw much light upon the subject of the old Palæogene deep ground. A tail-race has been constructed running north-west from a swampy river flat, evidently an old angle of the Ringarooma River, about east from the Brown Hill. The race passes through sandy clay containing numerous rounded large boulders of the Palæogene quartz-conglomerate, on one of which I noticed very faint leaf markings, not recognisable as to species. Higher up the race a black stiff clay is encountered, coloured with carbonaceous matter, but not yielding me any leaves. The cement boulders seem to be in the bottom layers of this clay and below them. Some are very large and heavy. The clay forms a false bottom on which the superincumbent gravels are being worked. These are nearly horizontally bedded, but have a slight dip south-east or away from the Brown Hill. The section seen in the face was the following:—

	feet	inches.
Surface soil	0	6
Layers of gravel, clay, and sand, but mostly sandy clay	10	0
Coarser gravel	0	6
Coarse sand with some clay	4	0
Coarse gravel and sand	2	6
Fine sand, much false-bedded, with occasional layers of wash	10	0
Black stiff clay false-bottom.		

A party of Chinese were working this at the time of my visit, and had just had a payable clean-up of their sluice. The conglomerate boulders belong to the same formation as the Brown Hill and the cements near Matthewson's Lagoon.

C. *River Gravels.*—These are characterised by the predominance of river shingle, consisting of flattened pieces of Silurian slates and sandstones. The quartz in them is generally sub-angular. Rounded quartzite pebbles are of rare occurrence. No hard-and-fast line can be drawn between these and the last division, some of the lower gravels of the latter and higher of this being very similar, the Mary claim, for example, being very like parts of Groves and Morrissey's terrace in character of gravel. These deposits were laid down in the bed of the river when it flowed at a somewhat higher level than now.

Near Gladstone the claims belonging to this class all lie on the east side of the river, with the exception of Mr. James Ogilvie's workings, which are in flat ground close to the river, and practically in part of its present channel. The terraces on sections held by F. Whitaker, east of Bell's Bridge, the Mary claim, Bromby and Dickenson's section, and Rushton and M'Kimmie's claim, near the Scotia ground, are all composed of river gravels. The Mary claim has been a very good one, and is still getting good tin. In the old workings there appears to have been difficulty in getting the tail-races low enough to work the back parts of the terrace. Rushton and M'Kimmie also appear to have a good claim. Besides their workings on the terrace they have opened up one of the river flats, but could not get drainage without using a hydraulic elevator. At South Mount Cameron the terraces worked so successfully by Mr. John Simpson near Smith's Creek, and the Red, White, and Blue claim, on the other side of the Ringarooma, are also river wash.

Two attempts have been made to work the gravels lying alongside the present river and under flood level, the most enterprising being that of the Long Reach Dredging and Tin Mining Syndicate at South Mount Cameron. This Company, at large expense, erected at their claim a Priestman dredge for raising the gravel. The plant was at first encumbered with a number of elevators and appliances of one sort and another, which were thrown out when the machinery got to practical work. Without going into details the following general description of the plant will be of interest as showing what can be done by this method of working. Two large punts were built, one of which carried the engine and crane of the Priestman dredge, and the other the trommels for separating out the coarse stones, the sluice-boxes for washing the finer stuff, and a Robey portable 12 h.p. engine, which drove the trommels and worked a centrifugal pump which raised the water required for washing the gravel. The engine for the Priestman dredge was of eight horse power. The grabs were made with teeth which fitted closely together when closed, with alternating pick and chisel points. The punts were moored to stumps of trees on the bank, and could be easily moved by hauling on the wire rope moorings into any desired position. The material raised by the grabs was dropped into a hopper, and thence into the trommel, into which also was discharged the water from the centrifugal pump. The trommel had holes ¾-inches in diameter, and was set on an inclination of one in nine when working, the punt being ballasted so that it would remain level when the hopper was full of material. The fine gravel passing through the trommel passed over sluice-boxes or ties, where it was raked by a workman, and thence by a swinging launder into the tail-race on the bank, and so into the river.

The heavy stones from the trommel discharged themselves into trucks, and were run into the river by manual labour. During the four months that the dredge was at work an excavation was made into the flat alluvial deposit forming the bank of the river about 250 feet long, 50 feet wide, and 15 feet deep, nearly 7000 cubic yards of material being handled, thus averaging about 70 cubic yards per day. Mr. Bewley, who was in charge of the operations, estimated the performance at 100 tons a day, or 600 tons a week, which agrees closely with the above estimate, a cubic yard weighing about a ton and a half. The cost per week for working expenses was £25, or tenpence per ton. Heavy trees and stumps in the surface soil added greatly to the expense. Under favourable conditions the expense might be reduced to sixpence a ton, but I do not think that any lower estimate could safely be made of the probable expense of this method of working in any of the tin districts of this Colony. The first cost of the plant is heavy, and though it works very efficiently and treats a large quantity of material, I feel pretty sure that the expense of running it is too great to make it profitable under any ordinary circumstances. A machine that will handle quantities of gravel at a cost not exceeding 1½*d.* to 2*d.* a yard is what is required for most tin-bearing gravels. The Dredging Company were particularly unfortunate, only obtaining about a ton of tin ore all the time. This, probably, is not a fair sample of the wash obtainable in the river bed: it is more likely that they were unlucky enough to begin work in a particularly poor place. It may be mentioned that there was some gold in the tin ore obtained, but I did not learn how much. The plant is now being dismantled and sold off.

The other attempt to work the river flats is being made by Mr. Jas. Ogilvie, with a hydraulic elevator of very primitive construction. The upraise pipe in use was simply ordinary thin galvanised iron tubing, and for a throat-piece a bit of cast-iron water-pipe was being used. The material was being raised 12 feet vertically by means of a pressure of 150 feet of water, brought across the river in pipes from the Mount Cameron Water-race. About three heads of water were being used for elevating, and two heads for sluicing. With the head available, not nearly so much water would be required for the elevator if it were of good construction. Mr. Ogilvie is to be congratulated on his enterprise in trying this method of working, which is one new to the district, though long in successful use in New Zealand and California. The hydraulic elevators are without doubt the most suitable machines for working the low-lying gravels by the side of the river, and the bed of the stream itself when the water is diverted by wing-dams, or taken away in flumes. A great deal of the difficulty experienced in the higher terraces also in getting rid of the tailings could be obviated by their use to elevate the gravel a few feet so as to permit it to be sluiced back into old workings. The tail-races would then only require to have enough fall to carry the finer tailings and waste water. There is not much printed information available as to the working of these machines, so I have collected as much as seemed desirable, and append it to this Report.

Water Supply.—The prosperity of every alluvial mining district depends more than anything upon the sufficiency or otherwise of the supply of water for sluicing purposes. The country round Gladstone is not well situated for being easily supplied with water, the only really high ground in the vicinity being the Mount Cameron Range, which, however, is not of sufficient extent to furnish constant streams of water. Between Mount Cameron and the Blue Tier, where never-failing supplies might be got, there is much low country, so low as to necessitate either very long lines of pipes or very high flumes in order that water might be brought over it to command the higher gravels. By the construction of the Mount Cameron Water-race the eastern side of the Ringarooma River has become possessed of a good supply of water, though even this race does not command the high deep ground near the old Garfield claim. On the Gladstone side of the river the owners of claims have still to be contented with the intermittent supplies available from storm waters which are not nearly enough for requirements, or with the water raised from the Ringarooma River by the Esk Company. Every small depression of the ground where a little rain-water can be caught and stored, and every little streamlet has therefore been secured by one or another claim-holder, and in wet weather a good deal of work goes on with this water. The disadvantages of this way of working with very small streams of water and much manual labour are very obvious when compared with the hydraulic method, and the only compensating advantage is that the water is cheap. In most cases, however, a steady supply of water of fairly high pressure would give the owner more profit, even if he had to buy it, than this intermittent working can. In order to get constant supplies of water various pumping plants have been at one time and another erected to force it from the Ringarooma River up to the claims. The Tamar and Scotia plants have been dismantled, and the only ones now at work are those belonging to the Esk and Colossus companies. The Esk machinery is very ingenious, the river being utilised to drive the pumps. A dam about 29 feet high has been put across the stream, acting as a weir in flood-time, and at ordinary times diverting part of the whole of the river into a flume which carries the water on to an overshot water-wheel, 20 feet in diameter, and with 18 feet of breast, said to be able to develop 97 horse-power. The wheel works reciprocating horizontal plungers twenty inches in diameter and with a stroke of 8 feet. These are fed with water directly from the flume overhead. A balance-bob is provided for overcoming the dead point in the revolution of the crank working the plungers. The plant labours under the serious disadvantage that it is liable to be submerged by floods, and even when there is only a heavy fresh in the river the disturbed water below the weir partly chokes the free working of the wheel. Water is forced to the Eureka and Esk dams on the eastern side of the river, and to a point on much the same level as the Eureka dam on the Gladstone side. Water raised by this plant is also brought across the Ringarooma from the eastern side by a line of pipes on a rough suspension bridge to the Syndicate's claim. The cost of working the machinery is about £30 a month, without counting cost of repairs of damage done by floods. All the claims near Gladstone township are now supplied with this water, which is sold for 18*s.* a sluice-head. In one case I noticed a piece of very bad policy. In order to save pipes the water was allowed to run downhill in a rough race a vertical distance of between 60 and 70 feet before being taken into pipes and led to the working face. The party were working with about 30 feet of head when they might have had 100. The difference in quantity of work done by the latter head would very soon pay for the pipes, especially as the gravel was somewhat clayey and hard to break down.

It has been proposed to bring a branch of the Mount Cameron Race across to the Gladstone side to serve the claims there. The branch would leave the main race at a point to the south-east of the Edina Sugarloaf, bend round the south side of the latter, and be carried by a siphon across the Ringarooma Valley, then round the shoulder of Ogilvie's Sugarloaf, and so to Gladstone, the total length being a little over five miles. The cost of a race to carry 20 sluice-heads of water is estimated at under £4000. There is no doubt but that such a race would be a great boon to the district. The end of the race at Gladstone is well above all the payable gravels, and it would command the whole of the ground between the township and the Ringarooma at Bell's Bridge. Here there is still more ground to work than has yet been taken out, and, worked vigorously with all the available water, there is probably at least three years' constant work. The principal other tin-bearing ground commanded would be the large terraces near Ogilvie's Bridge, worked by Ogilvie and Brown. The Enterprise terrace is, unfortunately, too high to be reached. On the two terraces there is work for the whole of the water for quite three years, as far as I can judge without actual measurement. There is thus work in sight for the water to be brought across for at least six years, in which time the race ought to have paid for itself, and given a fair interest as well. By the end of that period it is probable that the extensions of the workings on the east side of the river would require all the water that the main race is able to supply. In bringing this branch race over to Gladstone, the Government would, of course, be entering into competition with the Esk Company, who are now supplying most of the claims; (not, however, those near Ogilvie's Bridge.) It is not my province to enter into the question of the desirability of the State pursuing such a policy; but, leaving the Esk Company's claims to consideration out of account, there is no doubt in my mind as to the expediency of the work.

Another plan for supplying the Gladstone claims with water has been often suggested, and is worth consideration. It would have the great advantage of being a high level supply, and commanding the terraces on the north slope of Mount Cameron, which cannot be reached by either the Esk water or that of the Government race. On the other hand, there is great doubt as to whether a constant supply could be maintained all the year round. This scheme is to construct a large dam in the Deep Valley, at the head of Campbell's Creek. This valley lies pretty flat, and receives the drainage from the ridges all round, the catchment being about a square mile or rather more. It seems possible to construct a very large reservoir here with comparatively small expense, the sides of the valley coming together towards the outlet. The bottom is solid granite, which would afford an excellent foundation, and material for the dam could be cheaply got from the steep mountain sides. I have not been able to get any records of the rainfall at Gladstone, but that at Boobyalla is recorded in the Official Meteorological Reports. In 1888 there were 88 wet days, and a total rainfall of 19·86 inches. The maximum fall in any one month was in June, 4·23 inches; and the minimum in March, 0·10 inches. In 1889 there were 103 wet days, and a total rainfall of 36·04 inches, the maximum monthly fall being 10·39 inches, in November, and the minimum 0·67 inches, in February. The rainfall on the top of Mount Cameron is greater than at Boobyalla, but these figures will serve as some guide as to the quantity that could be collected. The average rainfall per square mile is 680,000 cubic feet, or 19 sluice-heads per day of 24 hours for each of the 191 wet days in the two years. If every drop of water were conserved this would only give a daily supply of five sluice-heads (equal to 15 sluice-heads for the working day of eight hours). The dam would have to be large enough to store the entire rainfall of any one month, and would be better to be able to take three months' rainfall. This might be taken at a maximum of 15 inches, which would require for the dam a capacity of 34,848,000 cubic feet, or 217,295,000 gallons. I doubt very much if this size of dam could be made without unreasonable expense, even though the ground is so very favourable for storage of water. A tolerably accurate survey would be required to test the possibility of this scheme. There is no doubt that a large reservoir in the Deep Valley would furnish a very good supply of water during the wetter months, but I do not think it could be relied on for a constant one. It might perhaps give enough water to enable the high gravels to be worked, and for this alone it deserves to be critically considered.

Prospects of the District.—My examination of the District was too short to permit of making surveys to determine the relative amounts of worked and unworked gravels, but I have no hesitation in saying that there is still far more ground untouched than has yet been sluiced, and that there are many years' work in sight still. The terraces near Petersen's claim and in the vicinity of the Scotia have hardly been more than commenced upon, and the large area of gravel at the Aberfoyle is still practically untouched. The Lochaber claim is working into still deeper ground, and will take years to work out. When the shallower gravels are exhausted there is still the deep ground to fall back upon. The value of this is unproved as yet, but it is likely that parts of it at least will be worth working. Finally, the District is not done with as a producer of alluvial tin until the bed of the Ringarooma River itself has been worked out. Various trials have been made of this in various ways with results less encouraging than might have been expected, still there can be no doubt that the bed of a river like the Ringarooma, which passes through tin-bearing country all along its course, and receives innumerable creeks which have all borne tin, must contain large quantities of ore It is a large ground-sluice, and cannot fail to have much tin concentrated in it. I cannot believe but that systematic and well-directed work on it would be remunerative.

It is a matter of national importance to ascertain the course and value of the old Ringarooma and Mussel Roe leads. The experience of the mines at Branxholm, Brothers' Home, and Bradshaw's Creek has demonstrated that the Ringarooma lead is especially a most valuable one, and every effort should be made to trace it further, and test it by borings. This is work which requires money, and is beyond the means of local claim-holders, and I would therefore invite the attention of mining adventurers to it, with every confidence that they will find it an unusually promising and legitimate enterprise. The Mussel Roe lead is more problematical, but also deserves attention. I would recommend that a more detailed geological survey of both these leads should be made, and that series of borings should be executed in places indicated by the survey as most likely to give reliable information as to the deposits. I am strongly of opinion that most valuable results would follow from such borings.

I have, &c.

The Secretary of Mines, Hobart.

A. MONTGOMERY, *M.A., Geological Surveyor.*

***TABLE** of Approximate Heights above Sea-level of various points in the Gladstone District, determined by Aneroid Barometer.*

(These heights are only rough approximations, and must not be relied on as accurate, having been taken with only one barometer, and during a period in which the barometer was very unsteady.)

	Feet.
Ogilvie's old dam, Deep Valley	679
Crossing of creek, Deep Valley, track to Sapphire Creek	612
Highest terrace gravels, near Wilson and Petersen's dam	460
Top of saddle, Mussel Roe Road, near Ogilvie's Sugar-loaf	450
Esk Company's dam	414
High gravel terrace, section 916, north of First Sugar-loaf	400
Top of Garfield terrace	396
Ridge of gravel between Eureka and Esk dams	387
Embankment of old Star dam	378
Petersen's terrace	364
Bottom of workings 6 chains south of Eureka dam	360
Top of old Tamar face	358
Top of old Enterprise workings	351
Gravel on road near dredging plant, South Mount Cameron	346
Top of Esk Company's pipes, Gladstone side of river	342
Eureka dam	338
Bridge on road at Old Star Creek	336
Top of ridge between Empress workings and Ringarooma River	333
Top of Edina Sugarloaf	329
Top of proposed Government siphon across Ringarooma River (Gladstone end)	328
End of proposed Government branch race	304
Terrace of gravel on road near Campbell's Creek	319
Top of Colossus terrace, South Mount Cameron	312
Bottom of Petersen's large excavation	310
Terrace of gravel on Dredging Company's section	308
Top of Pioneer Company's workings, Bradshaw's Creek	290
Top of C. A. Ogilvie's large excavation near Ogilvie's Bridge	288
Top of old Empress workings	279
Top of Mount Cameron Company's workings	279
Floor of *Gladstone Hotel*, Gladstone	270
Old shaft in deep ground, Upper Mussel Roe	266
Mallinson's workings on old Eureka claim	266
Terrace of gravel, Smith's Creek, South Mount Cameron	265
Top of spur between Mount Cameron and Fly-by-Night Creeks, on track	261
Gravel ridge, near Waterman's cottage, Scotia	257
Top of terrace, section 2286-87M, worked by Chinese and Petersen	256
Floor of Mr. John Simpson's house, South Mount Cameron	250
Top of Brown Hill, Aberfoyle	247
Bottom of C. A. Ogilvie's workings in creek near his house	245
Bottom gravels in Mount Cameron Company's workings	245
Top of Red, White, and Blue terrace, South Mount Cameron	245
Bottom of excavation, Ogilvie's Edina face	243
Outcrop of granite bedrock on road between C. A. Ogilvie's and J. W. Brown's workings	243
Intake of Scotia Branch, Mount Cameron Water-race	239
Top of Matthewson, Carlinn, and M‘Kimmie's workings, 2195-87M	238
Bottom of workings, old Empress claim	234
Top of Scotia Company's gravels, near water-race	234
Bottom of cement layer, Fly-by-Night workings	234
Bridge over Smith's Creek, South Mount Cameron	234
General level of country westward of Lochaber claim	216
End of Mount Cameron Water-race, turn-off to lagoon	216
Ringarooma River, at outlet of Colossus tail-race	207
Top of Matthewson, Carlinn, and M‘Kimmie's workings on 1282M	207
Top of Scotia Company's working face	198
Top of J. W. Brown's workings, near Ogilvie's Bridge	198
Top of Whitaker's workings, north-east of Bell's Bridge	198
Ringarooma River, at outlet of Simpson's tail-race, South Mt. Cameron	193
Top of old Martha workings	192
Top of Groves's workings, section 1188M	191
Top of Lochaber working face	189
Ringarooma River at Priestman Dredge, South Mount Cameron	187
Old Portland quartz claim, Mussel Roe	171
Top of Mary Company's terrace	171
Ogilvie's Bridge	171
Top of Rushton and M‘Kimmie's terrace, Scotia	162
Bottom of workings, old Martha claim	162
Bottom of workings, Mary claim	158

Lowest wash on Groves's terrace	158
Ringarooma River, at Ogilvie's Bridge*	149
Top of Esk Company's water-wheel	145
Bottom of Lochaber workings	144
Bell's Bridge	136
Flat near James Ogilvie's house	123
Outlet Lochaber tail-race, in Pig-and-Whistle Creek	122
Ringarooma River, at Esk water-wheel	118
„ „ crossing of Syndicate's pipes	116
„ „ Bell's Bridge	114
„ „ Rushton and M'Kimmie's cage	108
„ „ „ „ tail-race	107
Pioneer Hotel	326
Moorina Post Office	371
Gravels on Scottsdale Road, near Mount Stronach	371

(These last two heights are not likely to be nearly correct, but are given for what they may be worth.)

HYDRAULIC ELEVATORS.

As these very simple and highly efficient machines are not well known in this Colony, I have collected together from various sources a few facts about them which will be useful to mine-owners. They are largely used in California and New Zealand for raising gravel from low-lying situations to such a height as to permit of it being sluiced. For their most satisfactory working both high pressure and large volume of water are required; but these once obtained the cost of working is very small, thus giving these machines a great advantage over most others that can be used for raising gravel.

From an able article on "River Mining," by R. L. Dunn, in the ninth annual report (1889) of the State Mineralogist of California, the following description, and Figure 1 attached hereto, are taken:—

"*Deep-bar Mining by Elevators.*

"Where it is possible to obtain large heads of water under considerable pressure, the mining of deep bars (except where covered by slides) and extended areas of river-beds that have been opened by fluming, is most economically and rapidly effected by means of what are called hydraulic elevators or lifts. This style of plant has already been incidentally referred to in connection with the Golden Gate and Horseshoe Bar mines." (These references are quoted below.) "These elevators consist of a wrought-iron upraise pipe or barrel, of diameter dependent on the vertical lift and water-pressure available, those at present in use being from 11 inches to 20 inches in diameter. For convenience they are usually set on a 60-degree inclined framing, though the nearer vertical they are set the better they work. The length of the elevator is, of course, determined by the slope it is set on and the vertical lift made. The extreme lift now in operation is 89 feet, though I do not consider that the limit of practical efficiency by any means. The lower end is slightly flared out, set in the bottom of the pit open, and with the nozzle of the pipe, carrying water from the pressure-box from 200 to 500 feet above, projecting into it, and in the line of the elevator. A short distance above the nozzle a throat section is set in, narrowing it from 11 inches to seven and one half to ten, dependent on the amount of wear on the throat section, which, of course, can be replaced when worn too large. The upper end of the elevator is flared out a little, and discharges into a sluice-box with riffles for saving gold. The action of this elevator is by the stream of water coming from the nozzle of the pipe and forced through the elevator by the head from the pressure-box. This stream going through the throat section with its tremendous velocity creates a very strong suction, which lifts water, sand, gravel, and boulders from the pit and discharges them into the sluice, where the gold is caught and the tailings discharged on the dump. For the proper action of the elevator a large amount of water is necessary in the pit all the time. This water is first employed in ground sluicing, piping top gravel and waste off the pay gravel, and in washing the latter in the pit in small boxes with a sluice-head. Large boulders are handled by the derrick, or barrows, and piled in the pit on cleaned bedrock, and the fine material, after screening by a grizzly, goes into the elevator sump or pit and is lifted out of the mine. Where the elevator discharges into the sluice, the latter is covered by a heavy framing lined with green pine and liveoak logs, on which the water and gravel impinge before dropping into the sluice.

"For pumping water, and sand and fine gravel if necessary, another form of elevator is designed and used. In this, the foot of the elevator, placed, if desirable, 30 feet above the sump, is a solid pear-shaped casting, the nozzle screwing into the bottom, and discharging through the throat at the upper end. The suction pipes from the sump enter the sides of this pear-shaped casting.

"This class of machine is exceedingly efficient for pit mining. With it the problem of drainage is practically reversed, and the difficulty is not so much to get the water out of the pit as to get sufficient in to mine with. Quicksands and barren top dirt offer no serious obstacles to thorough mining, and the machine does the work of more men than could be practically worked on the same ground, and in a fraction of the time.

"The Mammoth Bar Mine in Placer County has been successfully exploited by means of an open pit, working through elevators, after unsuccessful attempts for 30 years to mine the same ground by drifting, and it is to this mine more than to any other that the credit of demonstrating the utility of these machines is due. The pit excavated in 60 feet depth of sand and gravel is now very large, and has increased the facility of working. Instead of sweeping all the top dirt through the elevators to the dump, it is sluiced back on worked-out ground, and only the pay gravel washed into the sump, at a considerable economy of water and time. This mine uses 400 inches of water under 450 feet head for its elevators; but its

HYDRAULIC ELEVATOR

IN USE IN CALIFORNIA

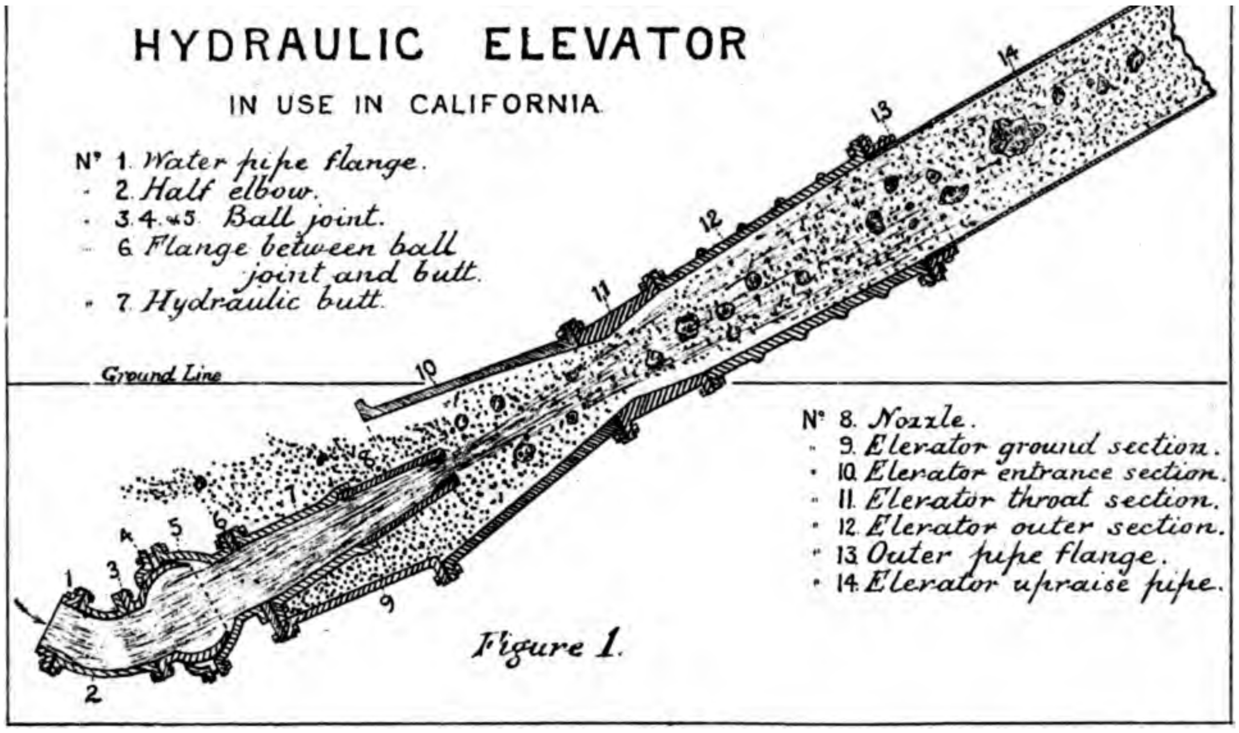

Nº 1. Water pipe flange.
" 2. Half elbow.
" 3.4.&5. Ball joint.
" 6. Flange between ball joint and butt.
" 7. Hydraulic butt.
Ground Line
Nº 8. Nozzle.
" 9. Elevator ground section.
" 10. Elevator entrance section.
" 11. Elevator throat section.
" 12. Elevator outer section.
" 13. Outer pipe flange.
" 14. Elevator upraise pipe.
1
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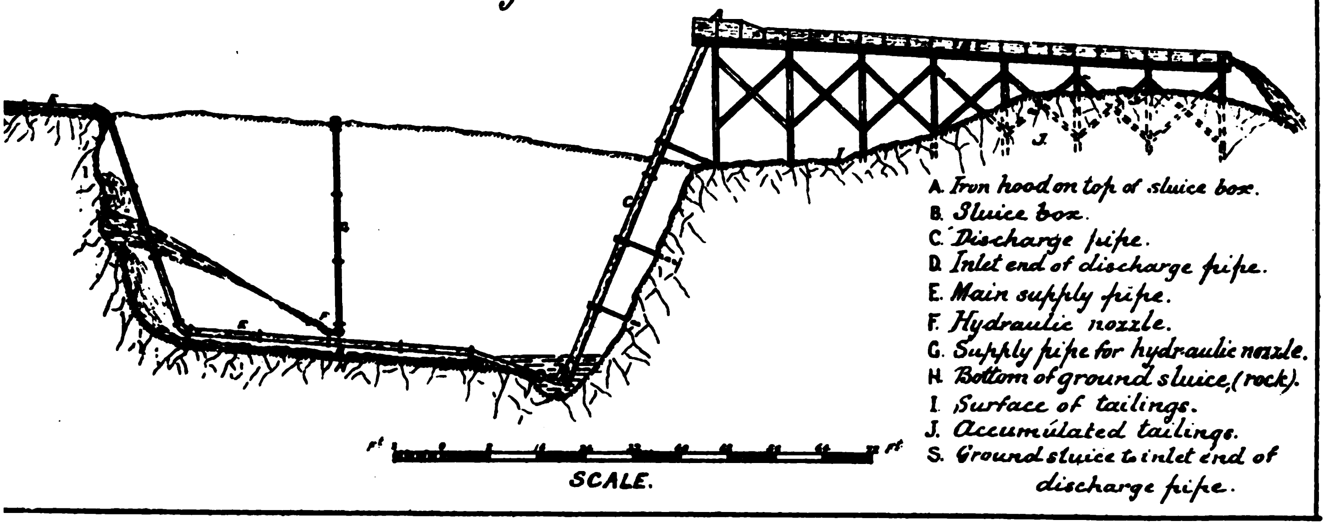
Figure 1.

PERRY'S ELEVATOR

AT GABRIEL'S GULLY, N.Z. (1886).

Figure 2.


A. Iron hood on top of sluice box.
B. Sluice box.
C. Discharge pipe.
D. Inlet end of discharge pipe.
E. Main supply pipe.
F. Hydraulic nozzle.
G. Supply pipe for hydraulic nozzle.
H. Bottom of ground sluice, (rock).
I. Surface of tailings.
J. Accumulated tailings.
S. Ground sluice to inlet end of discharge pipe.
SCALE.

SKETCH SECTION OF THE CAST IRON BOTTOM PIECE OF THE GABRIEL'S GULLY ELEVATORS (1891.)

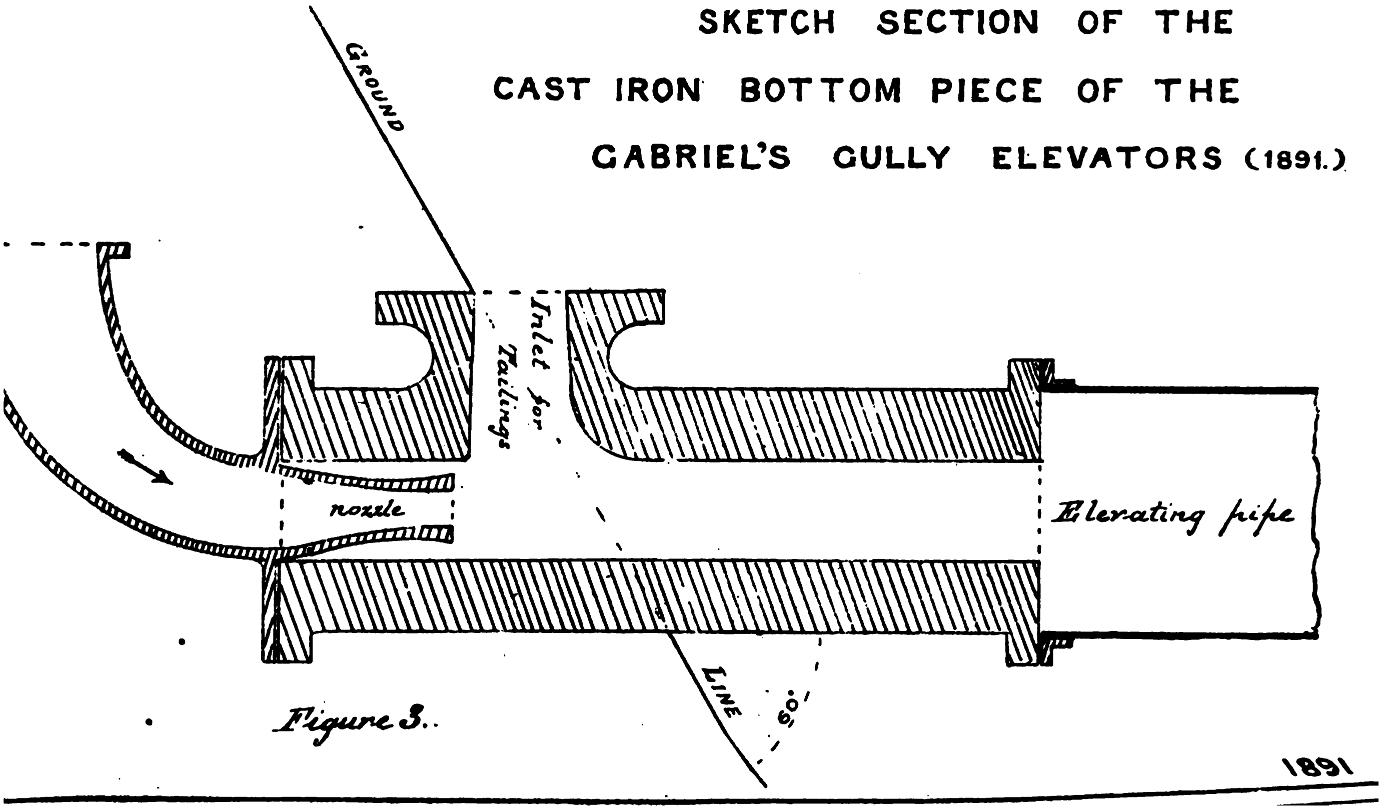


Figure 3.

experience has demonstrated that larger elevators and a larger supply of water would be still more economical, as the cobbles now moved by hand labour slowly and expensively could be then handled by the elevator rapidly and cheaply."

The references above alluded to are as follows:—

Golden Gate River Mine: "The pumping plant consisted of two elevators, two Chinese pumps with boxes 3 by 28 inches, and a centrifugal pump. The lift for the pumped water was 28 feet. The elevators had columns or barrels 11 inches in diameter, with a 10-inch throat, this latter proving too large for good work. They were operated with 275 feet head of water from the Palermo Ditch. One of them, with a 2½-inch nozzle, used 175 inches of water; and the other, with a 3-inch nozzle, took 208 inches."

Horse-shoe Bar River Mine: "The mass of sand and gravel overlying the pay gravel on the bars is so great that pitting by the usual method of hand labour is both too uncertain and too expensive to be advisable. The method of work approved and decided on by the owners of the property is the use of hydraulic elevators run by water under high pressure."

In another article in the same valuable Report, on "The Auriferous Gravels of California," the writer, Mr. John Hays Hammond, also refers to hydraulic elevators, and gives a photograph of those in use at the North Bloomfield Mine. "The capacity of this elevator is, according to Superintendent Radford, 2400 cubic yards per 24 hours. The gravel is elevated 87 feet vertically. One thousand three hundred miner's inches of water are required under a pressure of 530 feet. In addition to elevating the gravel, the 800 inches of water used in piping the 2400 cubic yards of gravel is also raised with the gravel." In a footnote, however, Mr. Hammond adds:—"Since writing the above I learn from Mr. L. L. Robinson, the President of the North Bloomfield Company, that the hydraulic elevator has been abandoned because of the great expense attending its operation. He thinks, however, that for heights up to about 40 feet the elevator would work to advantage under favourable conditions as to cost of water, &c. The company is making other experiments in this direction at present."

In reducing the Californian miner's inch to Tasmanian "sluice-heads," the former may be approximately estimated as 1½ cubic feet a minute, while the latter are 24½ cubic feet a minute. A Tasmanian sluice-head is therefore about 16 miner's inches. The expense of the enormous volume of water required for the North Bloomfield Company's large elevator, and the rapid wear of the elevator pipe, appear to have been the principal causes of giving up its use.

Elevators are much used in New Zealand in the sluicing districts of Otago and the West Coast. They were first introduced by Mr. J. R. Perry at Gabriel's Gully. "The Handbook of New Zealand Mines," published in 1887, gives opposite page 32 a diagrammatic sketch of the apparatus which is reproduced herewith (figure 2.) The following description is given by Mr. H. A. Gordon, Inspecting Engineer of the Mines Department, in his Annual Report of 1886 on the Mining Industry of New Zealand, page 73:—

"A large paddock is excavated out of the bedrock, and into this paddock the whole of the material is sluiced from the face. An upright or slightly inclined pipe, 15 inches in diameter and 47 feet long, is placed from the bottom of this paddock to a flume which extends for about two chains, and empties into another small tank where a second inclined pipe of same diameter is placed, having a vertical height of 37 feet; thence the whole of the water and sluiced material goes into a large flume, and is carried away as in an ordinary sluice-box, having ripples and false-bottoms to save the gold, the tailings being deposited in the bed of Gabriel's Gully. By these two lifts the whole of the water and tailings are raised a vertical height of 84 feet. To accomplish this about 20 sluice-heads of water" (the New Zealand sluice-head is 60 cubic feet a minute) "are required, having a head from 350 to 400 feet. Five sluice-heads are employed in breaking the cement and sluicing it into the lower paddock. Then seven and a half sluice-heads are employed to raise the water and tailings to the first flume, 47 feet in height, and another seven and a half heads are employed to raise it from the second tank or paddock up to the main sluice-box, 37 feet in height."

In his report of 1890 Mr. Gordon gives further information about the Gabriel's Gully elevators, as follows:—"At the time of my visit there was a scarcity of water and only two nozzles were at work. The bottom elevating-pipe lifted the material 14 feet into a flume 84 feet long and three feet wide, and then there was another elevating-pipe at the end of this flume which lifted the material 60 feet into another line of boxes, which carried the tailings clear of the paddock and workings and deposited them in the bed of the gully. . . . . There are two elevating-pipes at the upper paddock; the lower one lifts the material about 12 feet and the upper one 25 feet, and the tailings are deposited in the old worked ground." . . . . In reference to the quantity of material lifted, the manager stated that when he was lifting the material 87 feet 8 inches in two lifts, namely, one 62 feet 8 inches and one 25 feet, in 85 shifts, comprising 680 hours, he moved 26,920 cubic yards, which would be equal to 40,380 tons; and the gold obtained was 115 oz. 11 dwt. 16 grs., representing a value of £433 8*s.* 9*d.*, and the expenditure in connection with this work was £198 18*s.* This, therefore, shows that the quantity lifted to the height mentioned was equal to about 59·4 tons per hour, and that the value of the material was equal to about 2·58 pence per ton, and the cost of the work was equal to about 1·18 pence per ton. The quantity of water used was 350 inches—8¾ sluice-heads—with a head of 450 feet on the 62 ft. 8 in. elevating-pipe, and 400 inches—10 sluice-heads—with a head of 375 feet, on the 25 ft. pipe. The quantity of water used on the nozzle for bringing the material to the well where the bottom elevating-pipe was placed was 150 inches—3¾ sluice-heads—with a head of 375 feet.

In regard to the amount of work done with the quantity of water used, it appears doubtful if the data supplied are reliable, inasmuch as there is no comparison between the percentage of power employed to lift the material in the 25 ft. elevating-pipe and that used to lift the material in the pipe 62 ft. 8 in. To analyse this, it means that in the bottom 25 ft. pipe 10 sluice-heads of water was used under a head of 375 feet, which, disregarding friction entirely, would be equal to 426 theoretical horse-power, and the quantity of material lifted, being 59·4 tons per hour, is equal to 2218 lbs. lifted to a height of 25 feet per minute, or 55,450 lbs. a foot high per minute. The quantity of water lifted is equal to the quantity used for elevating *plus* the quantity used in nozzle for breaking down, namely, 10 + 3¾ = 13¾ sluice-heads, or 1,289,062 lbs. lifted a foot high per minute, thus making the total weight to be lifted 1,344,490 lbs., which is equal to 40·7 theoretical horse-power, and shows that 9·46 per cent. of the power is absorbed in friction. Again, the quantity of water used in lifting the material in the upper elevating-pipe is 8¾ sluice-heads under a head of 450 feet, which is equal to 447 theoretical horse-power. The weight lifted equals the quantity of water formerly used in the lower pipe *plus* the quantity used in the pipe in question, namely, 10 + 3¾ + 8¾ = 22½ sluice-heads, or 84,375 lbs., together with the weight of the solid material, namely, 2218 lbs., lifted to a height of 62 ft. 8 in., or 5,429,372 lbs. lifted a foot high per minute, which is equal to 164·5 theoretical horse-power, and shows that in this case only 1·71 per cent. of the power is absorbed in friction. Taking into consideration the loss of head due to friction of water in pipes, the quantity of water given for the work done by the upper elevator is too small, or else the quantity given for working the lower elevator is too great. (The percentages of absorbed power in the above calculation are of the actual work done, not of the total theoretical horse-power. In other words, the power lost in the first case is 9·46 times the power used, and 1·71 times in the second case.)

It will be seen from the above calculation, and from other instances that might be cited, that a great deal has yet to be learned as to the amount of head and quantity of water required to lift a given weight of gravel to a given height. Practice seems to vary very much in this respect, and no good working formula seems yet to have been made out.

In a private letter Mr. Gordon has been good enough to give me a few further particulars :—

"The elevating pipe is generally set on an inclination of from 55° to 60°, and the flange on the upper end is bolted on to the sluice-box. The pipe is made of steel plate of from 14 to 16 B.W.G. rivetted, with angle iron flanges every 16 feet, that is, the pipes are made in about 16 feet, or sometimes 18 feet lengths, with angle iron flanges at each end, and are bolted together with ½-inch screw bolts. The bottom pipe is generally made of cast iron about 4 feet long in the following manner." (See Figure 3 attached hereto.) "The pipes are generally about from 12 inches to 15 inches in diameter inside. The bottom pipe has a liner inside made of hematite iron. When the liner is new it is only about 6 inches inside diameter, that is, it has 4½ inches thickness of metal, and wears down until the internal diameter has about 9 inches diameter. I will give you the dimensions of the Blue Spur elevators. One of them is 83 feet long, set on an angle of 55° 30′ = 68′ 5″ vertically. The quantity of water used for elevating in this pipe is 500 inches, equal to 12½ sluice heads, with a pressure or head of 450 feet. This lifts about 56 cubic yards of tailings per hour, and also 300 inches of water (7·5 sluice-heads), which are used in the bottom elevator and sluicing nozzle, namely 150 inches (3¾ sluice-heads), which elevate 14 feet, and 150 inches which sluice down the tailings into the bottom of the pipe. They have another elevator of similar character. Two elevators are used where the vertical lift for one is too great. In the instance quoted the bottom elevator lifts the material and water 14 feet into sluice-boxes, and at the end of the sluice-boxes there is a well in which the other elevator is placed. If you can get water at a high elevation these elevators are splendid things, but they require a large body of water. A large number are now used here, and considerable improvements have been made on the first introduced. The head required to elevate gravel is in proportion to the height required to be lifted, which is from 10 feet to 13 feet for every 100 feet of head. Of course the quantity of water used also enters into the question greatly. If you can only get from 100 to 200 feet of head you could not calculate on lifting the ground more than 26 feet with the greatest head. The atmospheric elevators mentioned in my Report did not prove so effective as was anticipated,—indeed they are of no service except the intake orifice for the tailings or gravel is submerged, and this does not often take place. If the elevators were used in the bed of a river where the orifice was always submerged the atmospheric nozzle would be a great improvement. . . . . The diameters of the elevating nozzles vary from about 2¼ inches to 3 inches, but very seldom is the latter size used : 2¼″ and 2½″ are about the diameters used in all the hydraulic elevators here."

The atmospheric elevators referred to are described in Mr. Gordon's Report for 1889 at pages 62 and 73. In describing the Fair Maid and Gladstone claims at Addison's Flat, in the Charleston District, he says :—"A water-race is constructed from the dam to the edge of the terrace, and from this point the water is brought down to the claim in wrought iron pipes, 18½ inches in diameter, made of Nos. 12 and 10 B.W.G. iron. At the bottom of the terrace there are two branch pipes, 11 inches and 15 inches in diameter respectively, one for supplying water to the elevating nozzle, and one for supplying water for the breaking-down nozzle, both nozzles being 3½ inches in diameter. There is 240 feet head of water at the claim, and it is proposed to lift the material with this head to a height of 36 feet 6 inches, which is too high for the head to work satisfactorily, unless a current of air is admitted into the bottom of the elevating pipe. It has been clearly demonstrated that the lifting capacity of the water is greatly reduced when the water and tailings are allowed to cover the opening at the bottom, showing that a current of air mixed with the water increases the force, and it is almost impossible to prevent the opening at the elevating pipe being choked at times. A patent has been obtained in the Colony by Mr. Robertson for an air-pipe connected with the bottom of the elevating pipe to remedy this defect. . . . . I have since learned that working has been commenced, and that there are about 80 cubic yards of material lifted by the elevating pipe per hour, about one-half of which is stones and pebbles, which go into the hopper. Everything works extremely satisfactorily."

The other reference to atmospheric elevators is in describing Mr. John Ewing's claim at St. Bathan's, Otago :—"Mr. Ewing has made arrangements to have two patent atmospheric elevators fixed, which are guaranteed to lift the material 30 per cent higher than the ordinary elevator, such as is used at Gabriel's Gully. The difference in this elevator is that there is a double nozzle, having a small space between them. The outer nozzle does not stand so high as the inner one, through which the water passes, and it is connected with a gas-pipe, which, when screwed into the casting forming the nozzle, stands above the water in the well in a vertical position. The velocity of the water passing through the nozzle causes the air to rush in through the pipe, which has a cock on the upper end to regulate the supply. The elevating pipe, instead of being fixed down on the casting forming the nozzle, is held a certain distance above by four collar-bolts, having long screws on one end and double nuts to regulate the height. The ordinary elevator has a hole in the side of the pipe, having the bottom end placed down over the nozzle of the elevating jet instead of the pipe being suspended above it. This atmospheric elevator has yet to be tried, and Mr. Ewing is the first to try it. It will cost him £100 for each elevator. The guarantee that he has is that each elevator will lift one and a half times as much water as is used for elevating, together with as much material as can be sluiced down into the well from a height of 25 feet, with a head on the main supply pipe of 280 feet. . . . . At St. Bathan's Mr. Ewing has arranged to have another atmospheric elevator, making in all three of them ; but this one is to lift an equal amount of water to that used in elevating, together with as much material as can be sluiced into the well from a height of 57 feet, the main supply pipe having a head of 440 feet. It will be interesting to know how these patent elevators act, and if they possess the advantages claimed for them."

An interesting example of comparatively high lift with a low head is given in the same report in describing Mace and Bassett's claim, Addison's Flat:—" Their elevating pipe is 10 inches in diameter, with a 3-inch nozzle, and they lift the stuff 15 feet with a head of 75 feet, which is far too small a head to lift the stuff this height satisfactorily ; yet they are doing extremely well."

From the above descriptions it will be seen that there are great variations in the practice of hydraulic elevating. The use of two lifts in place of one where the distance required to be lifted is great appears to be a considerable improvement, and, after workings are well opened out, will often permit of a large proportion of the tailings being run back on to the worked-out ground without being lifted right out of the excavation. The first cost of the elevators is small, about £25, and the expense of maintenance is trifling. The liner, or bottom casting where no liner is used, in the bottom of the elevating-pipe, has to suffer a great deal of wear and tear through being battered by the heavy stones thrown against it by the force of the water. The Hercules Company, in Otago, now use solid castings seven inches in thickness, liners having been found not to stand, but to become splintered and broken. Mr. Gordon recommends the use of steel castings for liners and bottoms where heavy gravel has to be raised by a powerful jet. In some parts of the west coast of New Zealand I have seen the upper parts of the upraise pipes made of wood,—simply wooden boxes, in fact. These, however, are not so good as iron pipes, as they cause greater loss of power through friction.

In the following table I have colleoted all the principal facts that I have been able to obtain as to the working of elevators. The table is by no means complete, full particulars not being always obtainable.

Name of Mine.	Locality.	Size of Elevator Nozzle.	Size of Elevator Pipe.	Head.	Lift.	Material raised per hour.	Water used for breaking ground.	Water used for the Elevator.
		Inches.	Inches.	Feet.	Feet.	Tons.	Tasmanian Sluice-heads.	
Mace and Bassett's	Addison's Flat, N.Z.	3	10	75	15	...	...	...
Fair Maid and Gladstone........	" "	3½	11	240	36½	120	...	...
Hercules Company	Clutha Valley, N.Z.	3⅛	?	450	44	38½	11·2	17·7
" "	" "	3⅛	?	450	50	38½	11·2	17·7
Island Block Company	" "	2½	15	760	64	40	9·0	14·3
Gabriel's Gully, Consolidated, 1890	Tuapeka, N.Z.	2½	15	375	25	59·4	7·6	20·4
	" "	2½	15	450	62⅔	59·4	...	17·9
" "	" "	2½	15	450	14	84	7·6	7·6
" " 1891...	" "	2½	15	450	$68\frac{1}{12}$	84	...	25·5
" " "	" "	2½	15	420	12	...	40·8	
" " 1889...	" "	2½	15	420	35	...		
" " "	" "	2½	15	420	30	...	?	25·5
" " "	" "	2½	15	420	50	...	?	35·7
" " "	" "	2½	15	400	47	...	10·2	15·3
" " 1886...	" "	2½	15	350	37	...	...	15·3
Average (Dunn)	California	?	11 to 20	200 to 500	89 (max.)	...	...	...
Mammoth Bar	"	?	?	450	40	...	25	
Golden Gate River	"	2½	11	275	28	...	11	
" "	,	3	11	275	28	...	13	
North Bloomfield..................	"	?	?	530	87	150	50	81·3

A. MONTGOMERY, *Geological Surveyor.*

DIAMOND DRILLS.

Statement of Work done.

Year.	*Locality.*	*Direction of Bore.*	*No. of Bores.*	*Total Distance bored.*	*Average Cost per foot, exclusive of Labour and Fuel.*
	No. 1 DRILL.			feet.	£ s. d.
1882-3	Back Creek—For Gold	Vertical	7	1330	0 10 9
1883...	Lefroy—For Gold	Ditto	4	1011	0 5 3
1884...	Tarleton—For Coal	Ditto	1	401	0 5 6
1886...	Longford—For Coal	Ditto	2	1585	0 4 0½
1886-7	Harefield Estate—For Coal	Ditto	1	725	0 6 5
1887...	Cardiff Claim, Mount Malcolm—For Coal	Ditto	1	562	0 17 11¾
1888...	Killymoon Estate—For Coal	Ditto	1	504	0 4 7¾
1888-9	Seymour—For Coal	Ditto	5	2266	0 7 8½
1889 } 1890 }	Beaconsfield (Phœnix G. M. Co.)—For Gold[a]	Ditto	1	781	2 0 2
1890...	Beaconsfield (East Tasmania G.M. Co.)—For Gold[b]	Ditto	1	978	0 14 9½
1891...	Spring Bay—For Coal[c]	Vertical	4	748	Not yet to hand.
	TOTAL	...	28	10,891	
	No. 2 DRILL.				
1882...	Beaconsfield—For Gold	Horizontal, underground	1	68	No record.
1883...	Mangana—For Gold	Ditto	1	546	0 15 1
1884...	Guy Fawkes Gully, near Hobart—For Coal	Vertical	1	612	0 5 6
1885...	Malahide Estate, Fingal—For Gold	Ditto	5	1397	0 5 6
1886...	Carr Villa, near Launceston—For Coal	Ditto	1	571	0 5 4
1886-7	Waratah—Mt. Bischoff Alluvial T.M. Co.—For Tin	Ditto	7	1548	0 6 1½
	Waratah—Mt. Bischoff T.M. Co.—For Tin	Ditto	7	841	0 11 8
1887...	Ditto—Ditto	Horizontal, underground	1	53	0 7 8
1888...	Old Beach—For Coal	Vertical	1	593	abt. 0 10 9
	Campania—For Coal	Ditto	1	600	0 7 7½
	Richmond—For Coal	Ditto	1	500	0 5 1¾
1889...	Back Creek—For Gold	Ditto	4	787	0 8 5½
1891...	Macquarie Plains—For Coal	Ditto	2	831	Not yet to hand.
	TOTAL	...	33	8947	

Aggregate number of bores 61
Total distance bored........................... feet 19,838

[a] For details of this Bore see Appendix to Geological Surveyor's Report on Beaconsfield Goldfield, 10th July, 1891, *ante.*
[b] Ditto, ditto.
[c] Ditto, Spring Bay Coal, 29th September, 1890, *ante.*

W. H. GLOVER, *Commissioner of Gold Fields.*

Launceston, 30*th June*, 1891.

DIAMOND DRILL, No. 2.

Report of Strata passed through in boring for Coal at Macquarie Plains.

No. 1 Bore.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft	17	6	17	6
Dark sandstone, sharp and quartzose	2	5	19	11
Dark blue shale, mixed with quartzose sandstone	6	9	26	8
Grey sandstone	3	0	29	8
Black clod	0	6	30	2
Grey sandstone	0	9	30	11
Black clod	3	0	33	11
Grey sandstone	0	6	34	5
Black clod	1	0	35	5
Grey sandstones	3	2	38	7
Black clod	1	0	39	7
Grey sandstone	1	11	41	6
Black clod	0	6	42	0
Dark sandstone with coal markings	3	6	45	6
Grey felspathic sandstone (greywacké)	8	6	54	0
Dark grey fine-grained felspathic sandstone with coal stains	5	0	59	0
Black clod (felspathic mudstone) with coal streaks	0	4	59	4
Grey clod with coal markings	9	4	68	8
Purplish and grey coarse and fine-grained felspathic sandstones, with *phyllotheca*	11	0	79	8
Reddish grey felspathic mudstone and sandstone	11	9	91	5
Grey felspathic sandstone, with included mud pebbles, with a little coal	7	6	98	11
Dark clod	1	10	100	9
Grey clod with blue veins	4	0	104	9
Hard brown clod	6	8	111	5
Dark clod with fossil plants	0	6	111	11
Grey sandstone	4	10	116	9
Grey clod with plant impressions	0	9	117	6
Grey sandstone with plant impressions	6	1	123	7
Grey sandstone and clod with plant markings	9	0	132	7
Grey clod with plant markings	6	6	139	1
Grey sandstone	3	0	142	1
Grey clod and sandstone with plant markings	16	6	158	7
Grey sandstone	1	0	159	7
Grey clod	2	0	161	7
Dark clod with plant markings	0	6	162	1
Grey clod	5	6	167	7
Coarse grey sandstone (felspathic) with rounded mud enclosures; prints of *phyllotheca*	14	9	182	4
Grey clod	6	3	188	7
Grey sandstone	2	1	190	8
Grey clod	4	9	195	5
Grey sandstone	2	2	197	7
Fine-grained felspathic sandstone and mudstone with plant markings	9	8	207	3
Grey felspathic sandstone with rounded mud enclosures	6	8	213	11
Dark clod	1	0	214	11
Grey clod	3	4	218	3
Dark clod with fossils	1	6	219	9
Grey clod	1	4	221	1
Grey sandstone (felspathic) with coal markings	7	2	228	3
Grey clod	1	6	229	9
Grey sandstone with calcite veins	7	3	237	0
Reddish clod	0	6	237	6
Bluish clod	1	0	238	6
Coarse-grained grey felspathic sandstones with calcite veins	12	6	251	0
Dark clod with plant markings	0	2	251	2
Grey clod	0	7	251	9
Fine and coarser-grained felspathic sandstones and mudstones (clod) with carbonaceous markings	18	0	269	9
Grey fine-grained felspathic sandstones with carbonaceous markings	18	0	287	9
Grey sandstones with carbonaceous prints and a little calcite	10	0	297	9
Dark bluish mudstone (clod) with intermixture of a little felspathic sand, with carbonaceous prints and a little iron pyrites	6	0	303	9
Grey sandstone and calcite	1	0	304	9
Grey clod	0	6	305	3
Dark clod	1	2	306	5

No. 3.

COMPARATIVE Statement of Tin exported from Tasmania during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, *and for the first Half-year of* 1891, *compiled from Customs Returns only.*

YEAR.	TONS.	VALUE.
		£
1880	3954	341,736
1881	4124	375,775
1882	3670	361,046
1883	4122	376,446
1884	3707	301,423
1885	4242	357,587
1886	3776	363,364
1887	3607½	409,853
1888	3775¼	426,321
1889	3764	344,941
1890	3209¼	296,368
For first half-year of 1891	1561	139,364

No. 4.

QUANTITY and Value of Coal raised during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, *and first Half-year of* 1891.

YEAR.	QUANTITY.	VALUE.
	TONS.	£
1880	12,219	10,998
1881	11,163	10,047
1882	8803	7923
1883	8872	7985
1884	7194	6475
1885	6654	5989
1886	10,391	9352
1887	27,633	24,870
1888	41,577	37,420
1889	36,700	33,030
1890	50,519	45,467
For first half-year of 1891	21,870	19,680

No. 5.

RETURN showing the Number of Persons engaged in Mining during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, *and and first Half-year of* 1891.

YEAR.	NUMBER.
1880	1653
1881	3156
1882	4098
1883	3818
1884	2972
1885	2783
1886	2681
1887	3361
1888	2989
1889	3141
1890	2868
For first half-year of 1891	3133

No. 6.

RETURN showing the Number and Area of Leases held under "The Mineral Lands Act" and "The Gold Fields Regulation Act," in force on 30*th June of each Year since* 1886.

Nature of Lease.	In force on 30th June, 1886.		In force on 30th June, 1887.		In force on 30th June, 1888.		In force on 30th June, 1889.		In force on 30th June, 1890.		In force on 30th June, 1891.	
	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.
		Acres.		Acres.		Acres.		Acres.		Acres.		Acres.
Under "The Mineral Lands Act," for tin, &c., at a rental of 5*s.* an acre	627	24,077	656	22,892	957	32,231	1497	53,251	1303	49,463	1495	67,216
For coal and slate, at 2*s.* 6*d.* an acre rent	38	5487	62	10,665	41	6045	38	4499	51	7636	45	7255
Under "The Gold Fields Regulation Act," at a rental of 20*s.* an acre	110	1077	149	1474	285	2812	270	2687	325	3088a. 2r. 20p.	245	2366a. 2r. 10p.
Water Rights and Mining Easements	93	759 sluice-heads.	107	773 sluice. heads.	140	852 sluice-heads.	204	1005 sluice-heads.	209	950 sluice-heads.	200	998 sluice-heads.

No. 7.

RETURN of the Number and Area of Leases under "The Mineral Lands Act" and "The Gold Fields Regulation Act," in force on the 1*st July,* 1890, *issued during the Year ending* 30*th June,* 1891, *cancelled during the Year ending* 30*th June,* 1891, *and remaining in force on* 30*th June,* 1891.

Nature of Lease.	In force on 1st July, 1890.				Issued during Year ending 30th June, 1891.				Cancelled during Year ending 30th June, 1891.				In force on 30th June, 1891.			
	NO.	AREA.			NO.	AREA.			NO.	AREA.			NO.	AREA.		
		A.	R.	P.		A.	R.	P.		A.	R.	P.		A.	R.	P.
Under "The Mineral Lands Act," for tin, &c., at a rental of 5*s.* an acre	1303	49,463	0	0	442	24,466	0	0	250	6713	0	0	1495	67,216	0	0
For coal and slate, at 2*s.* 6*d.* an acre rent	51	7636	0	0	2	133	0	0	8	514	0	0	45	7255	0	0
Under "The Gold Fields Regulation Act," at a rental of 20*s.* an acre	325	3088	2	20	49	480	0	0	129	1232	0	10	245	2336	2	10
Water Rights and Mining Easements	209	950 sluice-heads			20	135 sluice-heads			29	87 sluice-heads			200	998 sluice-heads		

No. 8.

COMPARATIVE Statement of Net Revenue from Mines, being Rents, Fees, &c. paid to the Treasury.

YEAR.	AMOUNT.		
	£	*s.*	*d.*
1880	8944	5	11
1881	20,936	5	5
1882	23,077	1	9
1883	15,439	14	5
1884	6981	11	10
1885	11,070	5	7
1886	12,523	10	4
1887	14,611	11	5
1888	23,502	8	4
1889	17,254	9	0
1890	26,955	4	9

The above Statement does not include Stamp Duties upon Transfers of Leases and Registration of Companies, or the Tax payable upon Dividends, from which sources large sums are derived.

No. 9.

RETURN of Dividend Tax paid by Gold Mining Companies.

YEAR.	NO. OF COMPANIES.	AMOUNT OF DIVIDEND.			AMOUNT OF TAX.		
		£	s.	d.	£	s.	d.
1880	5	65,852	17	2	2467	16	0
1881	4	99,250	0	0	3721	17	6
1882	5	55,825	0	0	2093	8	9
1883	5	63,168	10	0	2368	16	4
1884	4	39,400	0	0	1477	10	0
1885	2	61,250	0	0	2296	17	6
1886	3	41,125	0	0	1542	3	9
1887	2	66,750	0	0	2503	2	6
1888	2	65,375	0	0	2451	11	3
1889	4	28,000	0	0	1050	0	0
1890	3	13,609	0	0	510	6	9
1891, 1st half of ...	2	4200	0	0	157	10	0

No. 10.

RETURN of Dividend Tax paid by Tin Mining Companies.

YEAR.	NO. OF COMPANIES.	AMOUNT OF DIVIDEND.			AMOUNT OF TAX.		
		£	s.	d.	£	s.	d.
1880	11	64,755	0	0	2428	6	3
1881	13	102,418	0	0	3840	13	6
1882	12	108,935	0	0	4085	1	3
1883	9	98,837	2	6	3706	7	9
1884	4	60,169	0	0	2256	6	9
1885	4	92,644	0	0	3474	3	0
1886	5	108,849	10	0	4081	17	1
1887	6	128,753	0	0	4828	4	8
1888	10	148,638	17	2	5573	19	10
1889	6	100,850	0	0	3781	17	6
1890	10	87,187	10	1	3269	11	1
For first half-year 1891	6	40,157	15	0	1505	18	4

No. 11.

RETURN of Dividend Tax paid by Silver-Lead Mining Companies.

YEAR.	NO. OF COMPANIES.	AMOUNT OF DIVIDEND.			AMOUNT OF TAX.		
		£	s.	d.	£	s.	d.
1891, 1st half of	1	8640	0	0	324	0	0

WILLIAM THOMAS STRUTT,
GOVERNMENT PRINTER, TASMANIA.

TASMANIA.

REPORT

OF THE

SECRETARY OF MINES

FOR

1891-2,

INCLUDING THE REPORTS OF THE INSPECTORS OF MINES,
THE GEOLOGICAL SURVEYOR, THE MOUNT CAMERON
WATER-RACE BOARD, &c.

Tasmania:
WILLIAM THOMAS STRUTT, GOVERNMENT PRINTER, HOBART.

1892.

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(No. 79.)

REPORT OF THE SECRETARY OF MINES.

Office of Mines, Hobart, 28th July, 1892.

Sir,

I have the honor to submit my Report upon the Mines Branch of the Lands and Works Department for the year ending 30th June, 1892.

Append

Appended will be found Reports of the various Commissioners upon the state of the Mining industry in the divisions under their charge; the Reports of the Inspectors of Mines; the Annual Report of the Geological Surveyor; the Annual Report of the Mount Cameron Water-race Board; Reports by the Geological Surveyor upon the Coal-fields at Oyster Bay, County Glamorgan; the Country traversed by the proposed Waratah-to-Zeehan Railway; the Ben Lomond Mining District; the Mathinna Gold-field; a Description of the Ore-dressing Machinery in use at the Tasmanian Silver Mine, Zeehan, by Mr. Richard Provis, A.M.I.C.E.; Returns of the Operations of the Diamond Drills, together with Tables showing the Yields of Gold, Tin, Silver, and Coal; the Number of Persons engaged in Mining; the Number of Leases and Area of Land held for Mining Purposes; the Net Revenue paid to the Treasury from Mines; with the Amount of Dividend Tax paid by Mining Companies.

General remarks.

Writing at this time last year, the opinion was expressed that at no previous period in the history of the Colony had the Mining industry presented a more hopeful aspect than at that time. Notwithstanding all that may be said to the contrary now, the stern logic of facts proves that that opinion was justified, and that at this date it may fitly be reiterated. The main hope of the Colony then rested upon the vast mineral resources of the West Coast Silver-fields; it does so still. True it is that owing chiefly to the financial depression which at present hangs over, not Tasmania alone, but all the colonies, the money necessary for developing those resources is not just now obtainable, and further to the fact that much money has been wasted by incompetent management, by the purchase and erection of inadequate machinery, and by the squandering of money in taking up for purely speculative purposes enormous areas of land upon which no mineral was known to exist, has caused, and is causing, an idea to prevail that the industry is decaying. It cannot be denied that gambling in shares, which some people call "mining," is, happily for the welfare of the industry, practically dead; but the fact remains, so far as these fields are concerned, that it is established beyond doubt that a large number of payable mines exist; that very extensive developments in the shape of opening the mines by means of shafts and adits, the erection of smelters, concentrators, and other machinery, the construction of railways, tramways, and roads are now in existence and in progress; that the quantity, value, and ease of treatment of the ores is proved. And is it, therefore, too much to expect that so soon as the present cloud of depression shall have rolled by, the silver lining will substantially reveal itself, and the silver mining industry will become a steady and permanent factor in the wealth of the Colony?

Other branches of the industry, which will be separately treated of later on, are in a satisfactory condition.

Discoveries have been reported during the year of gold, both in quartz and alluvial, at Warrentinna, near Branxholm, in the North-Eastern Division; of tin at Cox's Bight, on the South Coast; asbestos, at the Savage River; wolfram, in the North-Eastern Division; and graphite, on Cape Barren Island,—none of which have so far been extensively developed.

Some of the older established gold-fields—notably Mathinna and Lefroy—are again coming into prominence.

Under the provisions of the Regulation of Mines Act, which came into force on the 1st January, 1892, a competent Board of Examiners has been appointed to conduct examinations and issue certificates of competency for the office of Mining Manager. Regulations have been framed, and a scheme of examination laid down. The first examination takes place in September next. This step has long been felt to be necessary. The holder of a certificate will carry with him a credential as to his ability, which will be useful to him always; whilst the mineowner will be afforded a guarantee that the certificated manager he employs has the qualifications necessary to his fitness for his office. It is not yet proposed to make the holding of a certificate compulsory.

Much has lately been said and written regarding the enforcement of the labour covenants of Leases. The question is a difficult one to deal with, but it is contended that the existing practice is a fair one, and the best to be adopted under the circumstances. In all cases where an application for forfeiture of a lease is made the applicant and the lessee are called before a Commissioner, who, in open Court, hears the statements upon both sides and bases a recommendation thereon. This recommendation is then considered by the Minister, who makes such decision in the matter as the circumstances justify, and if the application is upheld then the applicant has a preferential right to take up the lease. This practice gives to those who desire to acquire unworked leaseholds a fair opportunity of doing so, whilst at the same time it prevents lessees who may, temporarily perhaps, be prevented from working, being, without sufficient cause, deprived of the capital and labour which they have in the past expended upon their leaseholds. It is satisfactory to note that many lessees are tributing their ground, a practice which, in the Zeehan and Dundas Silver-fields especially, may be adopted with profit to both lessee and tributor, and will help materially towards the fulfilment of the labour covenants.

The yield for the year has been 47,906 ozs., against 20,000 ozs. for the previous year. The increase is due to the satisfactory developments at the old-established gold-field at Lefroy and the alluvial workings at the Ring River. It is anticipated that Beaconsfield will again add its quota to the gold yield of the Colony. The Tasmania mine at that place, which has in the past produced at the rate of a ton of gold per year, having now acquired a magnificent pumping plant, will shortly be in a position to resume its outputs. The Warrentinna discoveries will doubtless be developed during the coming summer, and there are indications of successful results attending operations at Mount Victoria.

During the past year a great advance has been made in silver mining, notably at Zeehan and Dundas and in the Heazlewood and Whyte River Districts. Although only yet in its infancy, the industry has made very satisfactory progress. During the year, apart from the necessary preparatory work of opening the mines, constructing roads and tramways, and erecting machinery, &c., 1938 tons of ore and 590 tons of bullion have been exported; whilst upon the two fields of Zeehan and Dundas some twelve thousand tons of ore, valued at upwards of £61,000, is awaiting transit to the smelters. From the Maestri mine at Dundas 866 tons of bullion, containing 76,844 ounces of silver, has recently left the smelters. The progress of the Heazlewood District has so far been retarded by want of roads. A small parcel of 113 tons of ore lately sent from that district yielded 9000 ounces of silver and 60 tons of lead.

The excitement of what was known as the "silver boom" drew many of the miners from this branch of the industry in the early part of the year. The yield, however, has been 4784 tons, being one ton only in excess of the output for the previous year.

The only discovery of any importance during the year has been at Cox's Bight, on the S.W. Coast. This is an alluvial deposit at present of limited extent, but as it is in hitherto unprospected country, and has already attracted a number of practical miners, further discoveries in the neighbourhood will probably result.

Lode tin-mining is attracting considerable attention in the Blue Tier District, where there is known to be several lode deposits containing a payable percentage of tin. The present difficulty, however, is to provide suitable appliances for saving the tin. Some energy is now being thrown into the matter, and no doubt a means will be found to work the deposits profitably.

The output of coal for the year has been 40,000 tons, being a decrease of 10,000 tons against the corresponding period in 1890-1.

A fair amount of prospecting is being done with encouraging results by means of the diamond drills, and a seam which was discovered by that means at Seymour is now being opened out, and promises to be a good gas coal, which, from its proximity to the sea-board, should prove a very valuable deposit.

metals
inerals.

Excepting a discovery of asbestos at the Savage River and of graphite at Barren Island, both as yet undeveloped, but which may prove of considerable value, no important discoveries have been made during the year.

Evidences of activity.

During the year ending 30th June 1118 leases for 48,763 acres of land have been issued, and 1279 applications for 60,839 acres are in process of being dealt with, besides a large number of grants of water rights and easements.

Areas leased and applied for.

The areas leased and applied for are as follows—

For Gold	8915	acres
Silver	105,590	„
Tin	26,893	„
Coal	18,084	„
Other Minerals	5179	„
Total	164,661	acres

against 175,700 acres on 30th June, 1891.

Revenue.

The revenue for the year for rents, application fees, licences, miners' rights, &c., amounted to £34,852, against £35,942 for the previous year. This department is not credited with large sums paid into the Treasury for Stamp Duties upon the Registration of Mining Companies, Transfers of Mining Leases, Dividend Tax, and other items incidental to Mining.

Mining Companies.

During the year 162 Companies have been registered, with an aggregate capital of £718,354.

Division of the Colony.

For departmental convenience the Colony is divided into Districts, as follows :—The Northern and Southern, comprising the country on the right and left banks of the River Tamar as far west as the River Forth, and on the east to the Scottsdale District, with such mineral country as there is in the southern portion of the Colony, and includes the gold-fields of Beaconsfield, Lefroy, and Lisle. The North-Eastern District comprises the whole of the north-eastern country, including several important tin-fields, with the gold-fields of Mount Victoria and Waterhouse. The eastern District comprises the eastern portion of the Colony, and includes the tin-mining centres at Ben Lomond, Weldborough, and Gould's Country, with the extensive coal-bearing country around Fingal and Seymour, and the gold-fields at Mangana and Mathinna. The Western District embraces the wide area of country extending from the River Forth northwards, southwards, and westwards to the sea; it includes the celebrated tin-mines at Mount Bischoff, an extensive area of tin-bearing country at Heemskirk, the silver-fields at Mount Zeehan, Mount Dundas, and Heazlewood, the gold-field at the Linda, and other more or less important mining centres.

Departmental Staff.

The staff at the offices at Hobart and Launceston remains the same. An additional Inspector of Mines has been appointed: he is stationed on the West Coast, where he has done much valuable work.

The Inspectors of Mines.

The reports of these officers are annexed. It is noted with satisfaction that there has been but one fatal accident, whilst there has also been a marked diminution in the number of non-fatal accidents. I cannot but feel that the liability to accident has been greatly reduced by the careful supervision and advice of the Inspectors.

The Geological Surveyor.

Valuable reports from this officer upon the various portions of the Colony which he has visited during the year are in addition to his Annual Report, annexed hereto.

Diamond Drills.

The record of the work done by these machines will be found elsewhere in this Report.

Deep Sinking: Vote in aid of mining generally.

All sums available under these headings have been expended: it cannot be said that the results have been profitable, and it is not contemplated to ask Parliament to renew the votes.

Mount Cameron Water-race.

The Report of the Board which has the control and management of this Race is annexed, and may be looked upon as of a fairly satisfactory character.

In conclusion I may say that, excepting that it suffers from the financial depression which unfortunately is just now common to all classes of business, the mining industry of the Colony is in a progressive, healthy, and hopeful condition.

I have the honor to be,
Sir,
Your very obedient Servant,
F. BELSTEAD, *Secretary of Mines.*

The Honorable the Minister of Lands and Works.

REPORTS OF COMMISSIONERS.

Northern and Southern Division.

Mr. Commissioner Glover, in charge of this Division, reports:—

Lefroy.

The impulse given to prospecting activity by the success attending the discovery of a payable mine on the lode known as the "Pinafore" reef, to which I alluded in my last annual report, having at intervals received a stimulus from further discoveries, has now attained a pitch of excitement unknown at Lefroy since its earliest and palmy days. The special causes of this revival have been, not only that the discovery alluded to has maintained throughout the past year its successful character, but another mine has since been established on the same reef, which, up to its present stage of development, is considered to afford equally valuable prospects, and upon which crushing operations have just been commenced. Moreover a further discovery has been made within the last six months on a lode now known as the "Volunteer" reef, which on a trial crushing gave a yield of over 7 ounces of gold to the ton, and a recent crushing of 195 tons yielded 207 ounces. The encouragement afforded by these circumstances has caused great excitement amongst the class of prospectors, and there are now 53 Prospectors' Protection Orders in force on the Lefroy gold-field alone. Amongst the various abortive mining operations undertaken at Lefroy from 1871 to 1881 which after a short time were abandoned as unproductive, there were doubtless many which under competent management would have proved valuable aquisitions to the mining resources of the country; and it is on the site of one of these, known as the "Shamrock" claim, that the promising Volunteer mine alluded to is situated. It is but reasonable to expect that further discoveries of value will result from the labours of the many prospectors now on the field. It is also a satisfactory circumstance to record that a new Association, with the assistance of Victorian capital, is about to commence deep mining operations on the Chum line of reef, on the site of the formerly productive mines, which at length failed in their yield at the comparatively superficial depth of some 350 feet, and it is the general belief of experts that under competent management —by deep sinking—these mines will again be as productive as before. Further, there is a promising enterprise which has recently been entered upon by an association to search for a deep alluvial lead supposed to exist about a mile N.W. of the Township of Lefroy. These adventurers have obtained the use of one of the Government Diamond Drills, with the intention of sinking a succession of bores across the region indicated, and this work is now actively proceeding. The yield of gold from Lefroy for the past twelve months has been 14,219 ounces, value £56,182; the yield for the previous twelve months being 1762 ounces.

Beaconsfield.

At Beaconsfield no new developments have taken place, although the yield of gold has been nearly double that of the previous year. The most noteworthy occurrence has been the acquisition and final erection of the powerful pumping machinery procured from England, by the Tasmania Gold Mining Company. The Tasmania reef worked by this Company has, until recently, been the chief source of the gold yield of the country, but the production had materially decreased some two years ago, owing to the insufficiency of the machinery to cope with the subterraneous water; and although the requisite machinery is now established and in successful operation, there has been a great amount of "dead work" to be done on obtaining free access to the lower levels, and in consequence the Tasmania reef has not yet resumed its former degree of production. Nevertheless the yield of gold from Beaconsfield for the past twelve months was 12,320 ounces; value £46,067, whilst the yield for the previous twelve months was 6578 ounces. The seven other quartz mining operations on this field are still confined to underground prospecting, which is proceeding with varying prospects. The enterprise of the Ballarat Association in proving the deep alluvial lead at the base of the Cabbage-tree range, having attained a depth of over 400 feet, is now driving to the alluvial formation, there being now only another 100 feet, or three months' work, remaining, when the value of this "lead" will be ascertained. Efforts are still pending for the acquisition of capital to work various claims under amalgamation, but nothing definite has yet been accomplished.

Lisle.

The once busy and productive gold-field of Lisle is fast subsiding into abandonment, there being now only 22 persons upon it.

Denison and Golconda.

At the Denison and Golconda the great expectations indulged some twelve months ago have hitherto proved delusive, although several persons are still working on prospecting claims there.

Middlesex Plains.

Middlesex Plains has hitherto yielded no satisfactory results, and at present affords but little promise of doing so.

From the foregoing circumstances, and the fact that the yield of gold from Lefroy and Beaconsfield for the past twelve months amounted to 26,539 ounces, whilst that of the previous year was only 8340 ounces, it may reasonably be considered that the prospects of the northern gold-fields are highly satisfactory.

North-Eastern Division.

Commissioner O'Reilly reports upon the state of Mining in the North-Eastern Mining District:—

Gold.

A very material improvement has been exhibited in gold mining in this District during the past twelve months, a considerable amount of prospecting having been successfully carried on, and new finds made, which, so far, on being opened out to a moderate depth, the reefs appear to give promise of permanency and satisfactory returns.

Mount Victoria.

The prospects of the Mount Victoria Gold-field have considerably improved, principally through the successful termination of the spirited enterprise of the Mount Victoria Gold Mining Company in opening out their mine at a low level by a drive, the construction of which took considerable time, costing a large sum of money, and satisfactorily proved the existence of auriferous quartz in payable quantities in the reef thus opened out. This Company will shortly re-commence crushing with very good prospects of satisfactory yields.

Mount Horror.

There has been during the past year considerable activity shown in the Mount Horror locality in carrying on prospecting operations, which has led to a large area of land being taken up under lease, and eight mining companies being formed to mine the lands, six of which are mining and prospecting their claims, with results considered very satisfactory. On the Derby Company's claim a small battery is now being erected which will in a short time be in working order, and crushing will then be commenced. The trial crushings from this claim, as also from others in this locality, have been found very rich, and it only remains to be seen if the reefs continue to exist gold-bearing to a good depth.

The want of capital has been a considerable drawback to the more rapid development of the claims at this place, but notwithstanding this disadvantage a great deal of sound and legitimate work has been done. There are also a number of prospectors at work holding claims under Prospectors' Protection Orders.

On Mr. Gellibrand's freehold property alluvial gold has been found, and the prospects exhibited of a rich deep lead there are so encouraging and promising that a local company has been formed to mine an extensive area of land leased for that purpose.

Waterhouse and Lyndhurst.

I regret to observe that no mining has been done on the Waterhouse Gold-field during the past year, but the lessees of the "Southern Cross" claim there inform me that in a short time they will commence mining operations and the erection of a battery, &c.

Quartz crushed	26 tons.
Gold won	100 ounces.
Alluvial gold raised	25 "
Average number of men employed	40

Tin.

Cascade, (Upper) Ringaroom and Mount Maurice.

There has not been any improvement in the state of mining in these localities since my last annual report, but few miners being employed and the quantity of ore raised being small. It is apparently evident that at the Upper Cascade the richest portions of the alluvial deposits have been worked out. Although there is a considerable known extent of stanniferous ground in the Mount Maurice locality, the yield from it is generally so low that it cannot be worked profitably excepting during a period when tin holds a high price. I am informed that latterly several prospectors are at work in this locality.

I am not aware of any practical steps being taken to mine the tin lodes known to exist on the "Nugget" and "Star of Peace" claims. About 13 Europeans and 20 Chinese miners are, on an average, engaged in these localities; the quantity of tin ore raised during the twelve months being about 50 tons.

Branxholm.

There has not been any marked progress exhibited in the carrying on of mining operations in the Branxholm locality during the past year. Several of the claims have been steadily mined, and the returns are considered fairly satisfactory. No new developments have been made, but latterly a number of prospectors are at work in the back country. Fourteen claims have been mined, on which 44 Europeans and 47 Chinese have been engaged; about 160 tons of tin ore being raised.

Brothers' Home.

There is a considerable amount of activity and enterprise exhibited in the carrying on of mining operations on all the large claims in the locality of Brothers' Home. The yields on the whole appear to be satisfactory, and there is a very marked improvement in the prosperity of the place. The Brothers' Home claim still maintains its large output, 236 tons of tin ore having been raised from it during the past year, 22 Europeans miners being employed on wages, and the mine still appears promising of future large yields.

The "Triangle" claim, which is worked by underground mining, is progressing very satisfactorily, and so far as I can learn, promises well for the future. About 80 tons of tin ore have been raised from this mine during the past year. Fifty European miners are now employed in it on wages.

The "Briseis" Company have largely opened out their mine since my last Report, having had to contend with many difficulties in carrying on the work. Ninety tons of tin ore have been raised from this claim during the past year, and it is expected in a short time that the output will be very largely increased. On the adjoining claim, "The New Brothers' Home No. 1 Company" have resumed work about six months since, and during that period of time have raised about 86 tons of tin-ore, employing on an average about 33 European miners on wages.

On the whole about 520 tons of tin ore have been raised in this locality during the past year, 116 European miners being employed on wages.

Main Creek Moorina, a Wyniford River.

Many of the claims in the vicinity of Main Creek, Moorina, and Wyniford River are now in full work, and good progress made in the carrying out of mining operations, the yield being considered satisfactory. At Main Creek the "Black Boy" claim has yielded during the past year about 55 tons of tin ore; 4 Europeans and 14 Chinese miners being engaged on tribute.

At Bradshaw's Creek the Pioneer claim still maintains a good output, 50 tons of tin ore being raised during the past year, by 23 Chinese and 2 Europeans on tribute. At the Wyniford River the yields from the "Argus Company's" claim are but small as compared with the returns from it of former years.

The "Garibaldi" claim produced a large output for the past year, 165 tons raised by 40 Chinese on tribute. All the claims in the above localities are mined on tribute. About 30 Europeans and 169 Chinese are employed; the quantity of tin ore raised by them being 488 tons.

Mount Cameron.

There has not been any advancement in the state of mining in the Mount Cameron district since my last Annual Report, matters remaining pretty stationary. Thirty-seven claims are mined, principally on tribute, by 45 European and 133 Chinese miners; the quantity of tin ore raised being about 468 tons during the past year.

Miners' rights.

In the area proclaimed under the provisions of the Act 49 Vict. No. 3, available for mining purposes under Miners' Rights, between the Ringarooma and Mussel Roe rivers, I am informed that recently five men were engaged in two parties mining under the above authority, three of whom succeeded in raising twelve bags of tin ore in about six weeks.

Mount Horror and Mount Stronach.

But very little is being done beyond prospecting in the localities of Mount Horror and Mount Stronach, the tin deposits being generally poor.

A mineral, wolfram, heretofore new to this district, has lately been found, but sufficient time has not yet elapsed to ascertain if it exists in payable quantities. I understand that this mineral has a considerable market value, and is now in good demand.

Tin ore raised.

The total output of tin ore from the North-Eastern District for the year ending 30th June, 1892, amounts to 1704 tons 14 cwts., as against 1655 tons 1 cwt. for the corresponding period of 1891, there being an increase for last year of 49 tons 13 cwts. Considering the protracted drought in the late summer and early autumn months, and the consequent falling off in the supply of water to work the claims, this yield is on the whole satisfactory. I look forward to an increased output for the coming year.

Number of men employed.

During the past year there were on an average 250 European and 375 Chinese miners engaged in mining the claims.

General observations.

The depression that existed during the past two years in the tin-mining industry of this District, principally through the counter attractions of the silver-fields of the West Coast to capitalists, miners, and prospectors, is gradually passing away, and many who had left during the above period have lately returned with the view of recommencing mining operations, and I have no doubt that fresh capital will also presently find its way to assist in the development of the mineral resources of this District. On the whole it appears to me that mining operations on the several claims are being carried on with much enterprise and industry in a sound and legitimate manner, and I look forward to a marked improvement in the way of larger yields during the coming year.

Eastern Division.

Commissioner Dawson reports:—

Tin.

The output of tin from this division has been considerably in excess of that for last year. The lodes and dykes in the vicinity of the Blue Tier are in various stages of development, but so far I have nothing special to report.

Gold.

With the exception of the Reunion Gold Mining Company at Mangana, Mathinna is really the gold-field of this division. The leading mine, the New Golden Gate, has maintained its position during the year, and its prospects still continue first class. Prospecting is being actively carried on between Mathinna and the Upper Scamander, and I am informed that good prospects have been obtained.

Coal.

The output of coal from this district maintains its average both as to quantity and quality, and the industry appears to be now established on a firm basis. The East Coast Harbour and Coal Company are making preparations to open up a valuable seam on their property at Seymour, some 15 miles S.E. of St. Mary's, close by the sea. Harbour works to facilitate shipment of the coal are contemplated.

North-Western Division.

Mr. Registrar O'Neill reports:—

Silver.

As regards mining in this division I have little that is fresh to report. At the various mines in the Whyte River, Heazlewood, and Waratah localities work has been carried on steadily during the past year, and the prospects on the whole are very satisfactory; but for many reasons it appears to be necessary to erect concentrating machinery, and I believe the directors of some of the companies have this matter in hand. The quantities of ore sent away for tests have given very satisfactory results.

Tin.

The Mount Bischoff, the Stanhope, the West Bischoff mines, and the different alluvial claims are in full work, and with very satisfactory results. The extensive machinery at North Valley has now been completed, and no doubt will shortly be in full work.

Gold.

At the Savage River and Long Plains the alluvial miners are doing fairly well.

Western Division.

Commissioner Fowell, in charge of the Western Division, writes as follows:—

The universal commercial depression has materially affected the mining industry in this district, but at the same time it is satisfactory to notice that a considerable amount of energy has been shown by the leading companies on the field towards developing their properties by obtaining machinery, constructing tramways, and getting out ore.

In comparing the actual progress made during the last twelve months with preceding years the advance made is very noticeable, and must be satisfactory to all who are interested in the future of the field.

So far the development confirms the opinion that there are true fissure lodes both at Zeehan and Dundas.

The opening for traffic of the Strahan-Zeehan and Dundas Railway will now enable companies within reasonable distance of the line to obtain machinery at much less cost for carriage, consequently the same excuse can no longer be put forward for non-fulfilment of the labour clauses. This question is a matter which I respectfully suggest will require attention in the near future. At the present time large areas are held by companies who cannot, under present circumstances, fulfil the conditions required of them by their leases, but if they confined their operations to the land their capital will warrant them in properly working, and allow the balance to be worked upon tribute, it would much encourage independent industry, and very much increase the prosperity and population of the district. Should the area which is proved to be beyond their means to properly develop be too large to let to tributors, then it would be better to dispose of the interest in it to others and improve their property with the proceeds of the sale.

The Zeehan and Dundas Smelting Company have made a satisfactory start, and in a manner which shows they mean to make their venture a success.

The Argenton Smelting Company have also for some time been turning out bullion, but on a smaller scale.

It is to be hoped that every effort will be made to keep up a supply of mineral for these companies, and I would ask your consideration upon the charges made at the present time for the carriage of ore. There is in reality but little difference between the carriage of ore and bullion. To enable the ore to be smelted upon the field coke and flux have to be carried by rail, and consequently the charge for smelting at the present railway rates is higher than that charged in the neighbouring colonies. The result is that agents are now buying up from companies ore, and can afford to give better prices than the local smelting companies. The Railway Department in these cases only obtain one freight instead of three, and the Colony lose the advantage to be obtained by the money which would be expended here and the increase in the population caused by this industry.

During the last three months there has been a revival of prospecting for tin about Mount Heemskirk, and with fairly satisfactory results. This portion of the district must ultimately become valuable, and it gives me great satisfaction to report that attention is once more directed to it.

In the neighbourhood of the Ring River a considerable amount of gold has been obtained, and it has given employment to from 300 to 400 miners, which has been a great relief during the present depression. This portion of the district is gradually opening out, and valuable results, I am satisfied, may be looked forward to.

The Mount Lyell Company have pushed forward their operations vigorously since the re-organisation of the company, and the prospects of good results are looked forward to. The connection of this portion of the district with the port, by either rail or tramway, is absolutely necessary before much improvement can be expected.

I regret that the remaining gold-mining companies in this portion of the district have ceased operations. However, should mining be permanently revived at Mount Lyell, it will necessarily follow in the neighbourhood now neglected.

ANNUAL REPORT OF THE INSPECTOR OF MINES.

Inspector of Mines Office, Launceston, *27th July*, 1892.

Sir,

I have the honor to forward to you my Annual Report as Inspector of Mines for the year ending 30th June, 1892.

Mining Accidents.—I am glad to be able to report a diminution in the number of mining accidents, nineteen persons having been injured, as against twenty-seven in the year ending 30th June 1891. Only one fatal accident occurred, a Chinese being killed by the fall of a tree blown up by the roots by the wind, which struck him as he was at work in his alluvial claim. Of the remaining cases eight were accidents attended with severe injury, and ten with comparatively trifling hurts: all the injured men were Europeans.

The causes of the accidents come under the following headings:—

Falls of earth and rock.—Six men were hurt by these, four rather severely, two less so. Inquiry shows that these accidents could not generally have been prevented, no carelessness being chargeable to either the miners or the managers of the mines. In one case, however, the injured man complained that he had been ordered to do a piece of work which he had told the manager was dangerous. This accident had not been reported to the Inspector of Mines as required by law, and did not come to his knowledge till the time allowed by law for laying an information against the manager had expired, besides which he had left the colony.

Outburst of water.—Two men working in an alluvial mine were carried off their feet and sustained slight injuries from this cause.

Explosions.—Two men received injuries from explosions, one through inadvertently lighting the end of a fuse which was primed with a detonator, the other through putting a can which had contained dynamite on to a fire. No serious consequences resulted in either case. Both accidents were due to careless handling of explosives.

Fall of material down shafts.—Two men were slightly injured by falls of material down shafts: in one case the braceman was to blame, and in the other the injured man himself.

Fall of a tree.—As above mentioned, a Chinese was killed from this cause.

Falls of timber.—Two men were hurt by these, one receiving only trifling injuries, the other having his leg broken. Both cases were pure accidents.

Fall down shaft.—One miner was injured, but not severely, by falling some fifteen feet while doing work in a shaft: no blame was attachable to any one.

Truck accident.—While riding on a truck a man was thrown off by its coming in contact with an obstruction, and sustained a fracture of the thigh.

Cage accident.—A severe accident, resulting in the loss of his right hand, occurred to a man who was taking some measurements in the winding shaft at one of the plats. The cage came down unexpectedly and caught his arm. The accident was primarily due to his attempting to work in the shaft without first stopping the working of the cage.

Slipping of rope.—One man received serious internal injuries through the slipping of a rope with which he was lowering timber, he not having sufficient turns on the capstan. He admitted that it was his own fault.

The Regulation of Mines Act, 1891.—This Act came into force at the beginning of the present year. There is still a great want of familiarity with its provisions, especially with those which were not in the previous Act of 1881, on the part of many mining managers. Notices have been inserted in the *Hobart Gazette* for some months past drawing attention to the changes in the Act, and it is now being carefully attended to. The practice of raising and lowering men in shafts by means of buckets unprovided with safety appliances is still rather common, and several mining managers have been warned to put a stop to it. In some cases a mistaken and uneconomical parsimony in making the shafts too small to admit of a comfortable ladderway almost compels the men to ride in the bucket. I am afraid that it will be necessary to condemn a few of these shafts as unfit for men to travel through before owners will be brought to understand that the safety of the workmen must be considered as well as the cost of sinking.

Regulations.—Under Section 6 of "The Regulation of Mines Act, 1891," Regulations have been made by the Governor-in-Council prescribing terms and conditions for the issue of Certificates of Competency for the office of Mining Manager of a Mine, regulating the examinations for these, and appointing a Board of Examiners to conduct them; also prescribing conditions as to the manner in which the surveys of the underground workings of mines shall be effected. These appear to meet with very general approval from practical mining men, and, it is hoped, will tend towards improvement of mining.

Complaints from Miners.—A complaint was lodged with regard to the ventilation of the Mount Nicholas Colliery. On inquiry it was found that the matter had been remedied so far as there was any ground for complaint, and that the ventilation of the mine was satisfactory.

Another complaint that there were no platforms in the ladderway of the Ballarat mine, Beaconsfield, was examined into, and platforms were put in and the ladderway made as secure as possible under the circumstances.

These were the only two instances where the men working in the mines have complained as to the safety of the workings, which may be taken as evidence that the mines are in general kept in a state satisfactory to the workmen employed in them.

Mines visited.—During the year I have visited the Mount Nicholas and Dulverton Collieries, and the mines in the Whyte River, Waratah, Beaconsfield, Lefroy, Ben Lomond and Mathinna Districts. Inspector Harrison has visited those of the Mount Zeehan and Mount Dundas Districts, and sent in his Report separately.

I have, &c.

A. MONTGOMERY, M.A., *Inspector of Mines.*

The Secretary of Mines, Hobart.

(No. 79.)

REPORT OF THE INSPECTOR OF MINES AT ZEEHAN.

Zeehan, 8th July, 1892.

SIR,

I HAVE the honor to report that during the seven months that I have had charge of this District there has only been one serious accident, the sufferer being the only one to blame in the matter. I am happy to say he is now out of all danger.

Machinery.

There are about 24 pumping and winding plants on the field at present; most of it is new machinery. Many of the mines have had to shut down lately, the cause in some instances being the financial depression existing, and in others the steam pumps adopted by several of the companies not proving suitable for sinking where the water is heavy.

Boilers.

Boilers are especially good, and in most cases tested far above their working pressure.

Safety cage

In all cases where safety cages are used I have had them submitted to a practical test before allowing them to go into work.

Ventilation.

The ventilation of the mines is good; indeed we have no underground workings of a very extensive character to make it otherwise.

Explosives.

On being appointed Inspector of Magazines I had several parcels of damaged explosives destroyed. The magazine is now clean, and, with the assistance of the new Gunpowder Act, I hope to keep it so.

New Minin Act.

The new Mining Regulations seem to give all-round satisfaction. I find the mining managers are anxious to work in accordance with them.

In conclusion, I beg to thank the managers and miners for the kindness and assistance they have rendered to me, especially in the outside portions of the district.

I have, &c.

JAMES HARRISON, *Inspector of Mines.*

The Secretary of Mines.

ANNUAL REPORT OF THE GEOLOGICAL SURVEYOR.

Geological Surveyor's Office, Launceston, 28th July, 1892.

SIR,

I HAVE the honor to submit my Annual Report for the year ending 30th June, 1892.

During this period I have forwarded to you the following Reports of the results of my examination of the districts referred to:—

On the Coal Fields at Oyster Bay, in the County of Glamorgan.
On some supposed occurrences of Silver Ore near Tunnack, County of Monmouth.
On Brown Coal near Evandale Junction.
On the Country traversed by the route of the proposed Waratah-to-Zeehan Railway.
On the proposed boring for Coal at Langloh Park.
On a discovery of Coal at Plenty, Derwent Valley.
On the Ben Lomond Mining District.

I have also made a detailed examination of the Mathinna Mining District, a Report on which is now in preparation. Want of time has as yet prevented me from visiting and reporting upon the Mount Horror Gold Field and the mineral ground near Deddington, as instructed.

Beaconsfield Report—Correction.—In my Report on the Beaconsfield Goldfield, published with the Secretary of Mines' Report for 1890-91, on page 47 mention is made of a carbonaceous substance found in the Tasmania and Moonlight Mines. Further examination and analysis have shown this to be a lignite instead of nearly pure carbon as there stated. An explanation of this curious occurrence has been given in a paper by Mr. Ward, Government Analyst, and myself, read before the Australasian Association for the Advancement of Science in January, 1892, wherein the matter is fully discussed.

Coal Measures at Ravensdale and Prosser's Plains.

In the Report on these published last year, it was recommended that they should be tested by means of a Diamond Drill. As will be seen below, in the Report of the work of the Diamond Drills, this has now been done. The section of strata passed through are appended hereto. No coal was found at Ravensdale; before the drill had gone many feet the influence of the adjacent greenstone was observable in the hard and flinty character of the sandstones passed through, and at 113 feet the bore was abandoned, the bottom being in very hard quartzite and hornstone. The nearest greenstone visible on surface was over half a mile from the site of the bore. From this test it seems unlikely that coal will be found in this locality, and there is a very great probability that if any should occur it would be spoiled by proximity to the plutonic rock.

At Prossers' Plains two bores were put down. The first of these was about a mile south-west from Brockley House and nearly due south of the junction of the Back River with the Prosser River. This bore was 414 feet 2 inches deep, and did not cut any coal, being apparently in beds of the measures below the coal horizon. The second bore was in the flat westerly from the outcrop of coal in the Back River described in my previous Report, and to the dip of the seams seen there and in Robinson's shaft and drive. It went down to 436 feet and bottomed on greenstone without cutting any coal. There must therefore be a fault between the outcrop and the site of the bore, and the coal-bearing area can only be a very small one. It seems most likely that the coal seams once existed in this locality at a level a good deal above the present surface of the ground, and that a part of these higher strata has been thrown down by a fault to where we find the coal cropping out in the River.

Diamond Drills.—In the beginning of September last the charge of the Diamond Drills was transferred from Mr. Commissioner Glover to me. Both Nos. 1 and 2 Drills have been in use during the year, No. 1 pretty constantly, while No. 2 was idle from the middle of October to the beginning of May. Since last Report the No. 1 Drill has put down one bore for coal at Ravensdale, near Little Swanport, two bores for coal at Prosser's Plains, near Buckland, and one bore for alluvial gold at Lefroy, and is now engaged in making a second at the latter place. The No. 2 Drill having completed the boring at Macquarie Plains mentioned in last Report, was moved to Jerusalem, where one bore was made for coal, and thence was taken to Langloh Park, near Hamilton, where two bores for coal have been sunk, and a third is now in progress. It is probable that both Drills will continue boring in the neighbourhood of their present positions for some time to come. Both Drills are in good order: No. 1 has been furnished with a new boiler, and No. 2 with a new derrick. Sections showing the strata passed through are appended to this Report, together with a table showing the depths and cost of the bores.

The boring operations during the year have had varying success. No. 1 Drill as above mentioned was unsuccessful in striking coal at Ravensdale and Buckland, and in its first bore at Lefroy struck the slate bottom at 175 feet 5 inches without meeting with any alluvial wash dirt. Previous bores made in 1883 have shown that it is probable that the gutter will not be much less than 300 feet below the surface. The work now being done by this Drill is of a most important character, as there is much reason to expect that the deep leads in the Lefroy District will contain payable gold, and the results of the boring may be the cause of a great expansion of the mining industry. The second bore has now reached a depth of 209 feet, but has not yet bottomed. It is probable that a good many bores will be required before the position of the deepest ground can be satisfactorily located.

The No. 2 Drill was not successful in finding coal at Macquarie Plains; at Jerusalem it pierced three seams of coal of workable size but poor quality, and one four-inch seam; and at Langloh Park it has also been very successful, cutting one small coal bed in the first bore, and five, four of them of workable thickness, in the second. There seems every probability of a very fair coal-field being opened out in this locality.

I have, &c.

A. MONTGOMERY, *M.A.*, *Geological Surveyor.*

The Secretary of Mines, Hobart.

REPORT OF THE MOUNT CAMERON WATER-RACE BOARD FOR THE YEAR ENDING 30TH JUNE, 1892.

SIR,

19th July, 1892.

This Board has the honor to report as follows.

Meetings of the Board.

The Board has held three meetings during the year, and the Race and Works have been inspected by the Chairman and by individual members on various occasions during that period.

The staff.

The staff remains unaltered, viz., a manager and four watermen and channel-keepers.

New works.

During the year a new waterman's cottage has been erected, at a cost of £44 10s. Fluming No. 38 has been entirely and substantially renewed, at a cost of £381, and the manager's house and watermen's stations have been placed in telephonic communication at a cost of £140. All these works were found to be necessary, and have added considerably to the safety and economical working of the race.

Proposed Branch Race to carry water to the western side of the Ringarooma.

The contemplated construction of a Branch Race for the purpose of supplying claims on the western side of the Ringarooma River has been abandoned for the present, for this reason, that at present all water that can be brought in by the main channel is in demand by claimholders along the line: should this demand fall off, then possibly the construction of the Branch may be fitly undertaken.

Condition of the race.

The race generally is in good order, but for several years to come considerable annual expenditure will be required in renewing flumings upon the old portion of the race purchased from the Company. In crrrying out this work advantage will be taken of all opportunities to shorten the race, and to substitute earth channels for fluming, and thus reduce the cost of maintenance.

Regulations.

On the whole these are working well and satisfactorily to the customers for water. During the year new regulations have been framed, reducing the price of water to the minimum rate, viz., 10s. per head per week of 6 days of 8 hours each, for water used for prospecting purposes only, for working turbines and hydraulic elevators, and for water used upon the area commanded by the old portion of the race. These provisions have been extensively availed of, and have been of great practical utility.

Statistics.

The statistics for the year are as follows:—

Average per week of claims supplied	18
Total number of heads of water supplied	3699
Tons of tin ore raised (approximate)	202
Average number of miners employed per week—	
Europeans	23
Chinese	57

Revenue.

	£	s.	d.	
Total receipts for the year	2571	1	0	
Cost of maintenance and management	1071	18	5	
Paid to Public Debts Sinking Fund for the year ending 31st December, 1891	1362	3	7	
Total paid to Public Debts Sinking Fund	1782	13	0	
Rate (for the year) of interest upon the cost of purchase and construction	4	13	0	per cent.

We have the honor to be,
Sir,
Your obedient Servants,

F. BELSTEAD, *Chairman.*
C. O'REILLY,
S. HAWKES,
A. MONTGOMERY,
JOHN SIMPSON,
Members of the Board.

The Hon. the Minister of Lands and Works.

REPORT ON THE COAL FIELDS AT OYSTER BAY, IN THE COUNTY OF GLAMORGAN.

Geological Surveyor's Office, Launceston, 14th November, 1891.

Sir,

I have the honor to report that, in accordance with your instructions, I went to Swansea on the 28th of October for the purpose of inspecting several localities in the vicinity of Oyster Bay which have been considered likely to contain coal and other minerals. A prospecting association has been formed in the district for the purpose of testing these places by means of a diamond drill should the indications of coal be considered sufficiently favourable. My attention was therefore specially directed to the selection of localities where prospecting by boring could be carried on with the greatest advantage.

As this was only a flying visit no attempt has been made to survey the limits of the various formations seen, and on the maps sent herewith for explanation of this report these are only very roughly laid down, being sketched in mainly from information received from local residents. Should boring operations result in finding payable coal, it would be desirable to have a detailed geological survey of the district made in order to accurately define the probable coal-bearing areas. The maps are, however, sufficiently near the truth to give a good idea of the position and approximate extent of the coal measures.

Throughout the whole district the predominant rock is diabase greenstone. This forms all the hills inland from Oyster Bay, and extends without noteworthy interruption almost to Ross and Campbell Town. One or two small ridges and hills near the coast are composed of coal-measures sandstones, but as a rule the latter are only found in low-lying ground—in the valleys and flats. Going northward from Little Swanport we find them at Lisdillon and Mayfield, and again at Kelvedon, in patches of several hundreds of acres, after which nothing but greenstone is encountered until after crossing the Meredith River, when we reach extensive alluvial flats lying at the mouth of the Swan and Wye Rivers. A ridge of greenstone divides the valley of the Swan River from the Moulting Lagoon, but the latter and the flats just mentioned must be regarded as having been at one time shallow portions of Oyster Bay, which have in course of time been more or less filled up by the detritus brought down by the Meredith, Wye, Swan, and Apsley Rivers, or, possibly, elevated above sea-level by a slight rising of the land. Throughout all these flats occasional traces of the coal measures are met with, though the covering of alluvial matter is so thick that an occasional exposure of sandstone is all that is seen. Not only is there the covering of recent alluvial debris to obscure the older formations, but also a deposit probably belonging to the early Tertiary period, which, in places, is of considerable extent. This is met with on the main road about half a mile south of the Riversdale homestead, again at the junction of the Campbell Town and Bicheno roads, and is also well seen in a cutting on the latter road about half a mile north from the junction. Traces of it are again met with in the bank of the Swan River, opposite Glen Gala homestead, and also to the north west from this, on the slopes of some low hills, composed of coal measure sandstones, which there bound the alluvial plain of the

Swan River. This deposit is made up of clays, beds of flaky impure brown iron ores, and highly ferruginous sandstones. At the junction of the roads a few fossil leaves were obtained in these last, closely resembling those found in the very similar leaf-beds of the Windmill Hill at Launceston, which are of Palæogene age. These Oyster Bay Tertiary beds have been much eroded since their formation, and are now only seen where they project as low hills through the later deposits of recent alluvial gravels. Their existence is most likely due to there having once been in the now Swan River valley a lagoon similar to the present Moulting Lagoon at the mouth of the Apsley River. This would argue that the general level of the land was in early Tertiary times much lower than at present,—a conclusion borne out by the other Tertiary deposits found at intervals all round the coast of Tasmania.

So much of the surface of the flat lands at the mouth of the Swan River being covered with these recent and Tertiary formations, and natural sections of any depth being few and far between, it is not easy to form an opinion with any certainty as to whether the coal measures exist below them. Near the junction of the Campbell Town and Bicheno roads, however, sandstone has been quarried for building purposes which is evidently got from the coal measures. It is the characteristic soft greyish felspathic or argillaceous sandstone so commonly met with in our coal measures above and in the vicinity of seams of coal. The same sandstone occurs again in a detatched patch near Bellbrook, on the Wye River, and in the Swan River about a mile above Glen Gala homestead, about which occurrences more will be said presently. These isolated outcrops render it very likely that the carboniferous formation underlies a great portion of the alluvial flats. It would seem, indeed, that the whole of Oyster Bay had been once a coalfield, the remnants of the coal formation at Schouten Island and the south-west corner of Freycinet's Peninsula showing that it had extended to the east side of the Bay. Whether it has happened that the soft sandstones have been worn away in course of time by the rivers and the encroachments of the sea until water now occupies the place once held by dry land, or whether, as is possible, the coal measures in the floor of Oyster Bay have never been elevated into dry land, is of no economic importance, as in either case any coal contained is quite out of reach. We must make the best of such remnants as now exist along the shores. That the coal measures once existed in the flats at the mouth of the Swan River is, to my mind, hardly disputable; but to ascertain their present condition two serious factors must be taken into account, namely, the amount of erosion they may have suffered prior to the deposition of the Tertiary and recent beds that now cover them, and the amount of disturbance and alteration they may have been subjected to by intrusive masses of igneous rock (the greenstone). Before any conclusion can be definitely come to on these points borings will have to be executed. We cannot by any means foretell the depth of the basins and possible valleys that had been scooped out of the underlying rock before the superficial deposits were laid down, neither can it be predicted how and where the intrusive greenstone has broken through it. This latter feature is the one that is most to be feared, as being the more likely to lead to serious destruction of the coalfield. The numerous outcrops of solid greenstone even in the flat land prove that disturbance from igneous intrusions must be expected. The large area of possible coal-bearing land, however, gives grounds for hoping that there may be patches of undisturbed country worth working; and testing the ground by means of a diamond drill is therefore desirable, though it cannot be said that the prospects of a return for the expenditure are very good. Even supposing that the fears above expressed as to the coal measures being cut away by erosion or destroyed by igneous intrusions should prove to be groundless, there would still be the by no means unlikely chance that workable coal would not be found in them. The enterprise of boring, though highly commendable as proving the value of the district, is therefore not one that should be entered into with sanguine hopes of profit being the result; it should rather be regarded as one of the things that should be done in the public interest to set at rest a question of great importance to the whole community.

As in most of our Tasmanian Coal-fields, the relationship of the igneous greenstone formation to the coal measures with respect to age is a subject of the greatest importance, as on it depends the possibility of coal being found to extend right under the high hills of greenstone which appear to bound the carboniferous sandstones on the westward side. This has always been a matter on which there has been much difference of opinion among Tasmanian geologists. While all are agreed that some of the greenstone is of later age than the coal measures, of which fact there is abundant proof in numerous sections where the plutonic rock is seen to traverse the sandstones, it is a matter of controversy whether all the immense hills and masses of greenstone have been erupted since the coal was laid down, or if these were not two main periods of outflow of molten rock, one antecedent and one subsequent to the formation of the coal measures. Mr. R. M. Johnston, in his Geology of Tasmania, comes to the conclusion that the latter theory is the correct one, and speaks of a "newer" and an "older" greenstone. In this he is supported by the high authority of Dr. Selwyn, who, in describing the district in the vicinity of the Douglas River (Report upon some of the Coal Seams of Van Diemen's Land, 1855), says:—"Inland the country rises into massive greenstone ridges, against the steep escarpments and in the hollows of which the carboniferous beds have in all probability been deposited. One is irresistably led to this conclusion from the apparently undisturbed and unaltered condition of the latter even where they are in closest proximity to the igneous mass." While very unwilling to differ from two such high authorities, my own observations in the field, coupled with the results of several borings made lately with diamond drills at Seymour, Spring Bay, Macquarie Plains, and Jerusalem, have led me to an opposite conclusion,—that the greenstone eruptions took place after the coal measures were laid down. It is impossible to prove that none of the greenstone existed before the coal era, but I would contend that if the great masses of it that exist inland from Oyster Bay can be shown to belong to the "Newer" Greenstone there is no reason for not conceding that the exactly similar greenstones of the Great Central Plateau, Mount Wellington, Ben Lomond, and other mountains, which have been assumed to be older than the coal measures, belong to the same period of immense eruptive activity. The fact that alteration of the sedimentary strata in the neighbourhood of the Douglas River was not observed by Dr. Selwyn is not of itself sufficient to prove that the greenstone there was of different age from that at Lisdillon and Mayfield, where extreme metamorphism of shales in its vicinity is very noticeable. The igneous formation is continuous from the Douglas River to Lisdillon, and if the question of an older and newer

greenstone had not arisen no one would ever have thought of disputing the identity of the rock at the two places. The extraordinarily partial action of volcanic intrusions in disturbing and metamorphosing the strata penetrated by them has often been noticed and commented upon, rocks being found at one time penetrated by igneous dykes and yet hardly at all altered even at the contact surface, and at other times changed almost beyond recognition. So, too, the dykes appear in cases to have worked their way through the rock without greatly or even appreciably disturbing the strata, while in other cases great bending and fracturing has been caused. The evidence that has been brought forward in favour of the theory of the existence of a pre-carboniferous greenstone appears to me to be easily explainable by this well-known behaviour of igneous intrusion. Besides the want of alteration and disturbance of strata in contact with the greenstone in certain sections, it has been put forward by Mr. Johnston as proof of there being greenstones of two different ages that he has observed a dyke of greenstone clearly penetrating an older mass of the same rock. This, however, should not be held to prove any considerable difference in the age of the two bodies, as it must frequently happen in the course of eruptions that dykes are thrown up through lava flows and other sheets of igneous matter of very recent formation.

Whether the enormous quantities of greenstone found throughout the whole colony are older or younger than the coal measures, the eruptions must have been of vast extent, and partaking rather of the nature of "fissure eruptions" than of those of the ordinary crater type. If this is allowed, it seems to me that there is no difficulty in believing that the elevation of the central and eastern part of the island was due to the outflow of these great molten masses, and that they forced up with them large portions of the surface strata. It is very possible that much of the rock now exposed on the surface was originally buried, the molten matter having formed intrusive sheets and "laccolites," from which the covering sandstones have been in course of time removed by denudation. This theory of the disruption and elevation of the coal measures by a mesozoic outflow of molten rock appears to me to satisfactorily explain the very broken nature of our coal measures, the great differences in elevation of very similar beds and the constant presence of dykes of greenstone, much better than that which assumes that the coal-bearing beds were originally laid down in an archipelago of greenstone islands, and that the differences of elevation have been caused by numerous faults and the intrusion of a second outflow of igneous material. When it is possible to account for the facts by referring all the greenstone masses throughout the colony to one great period of volcanic activity, it should require very strong evidence indeed to support the belief that there had been a similar period of very much greater age in which greenstone indistinguishable from that of the second period had been poured out.

A certain amount of positive evidence that the coal measures were not laid down in hollows of the pre-existent greenstone rocks is in many places afforded by the mineral constitution of the former. A good example may be seen in the Freestone Creek, which runs into the Wye River about two miles west of the Bellbrook homestead, in the district now under consideration. Here we find a limited patch of the coal measures, consisting of beds of grits, sandstones, and shales. In the Freestone Creek there is a considerable thickness of strata laid open to view. Though surrounded for miles in every direction by massive greenstone hills, the beds in this little hollow show no sign of having been derived from the disintegration of the circumjacent rock. Several of the beds contain coarse boulders and stones, but these are not fragments of greenstone, but of granite and Archæan or Silurian schists, slates, and sandstones. The coarse white grits, too, have all the appearance of being derived from the disintegration of granite. Mica is common throughout the beds. No possible doubt can be entertained after an examination of this section that the strata were derived from granite and Archæan and older Palæozoic rocks, and not from the greenstone now surrounding them. Though the patch is a small one and surrounded by a vast mass of once molten rock, no unusual hardening or change is apparent, and the strata lie inclined at low angles, the "undisturbed and unaltered condition" noted at the Douglas River by Dr. Selewyn obtaining in this locality also. Yet it is inconceivable that the sediments deposited in this small basin should have been derived from far distant granitic and Archæan formations without containing a very much larger proportion of material from the sides of the basin, the coarse pebbles and small boulders found proving that the strata were not laid down in deep water. The effect of the heat of the igneous mass is shown in some places, however, there being a great deal of vertical jointing visible on close inspection.

On the north coast of Maria Island there is a splendid section of the lower beds of the carboniferous system (described in my report of 19th September, 1890, on the Hydraulic Limestones of Maria Island), one end of which abuts against a large mass of greenstone. The lower beds of the limestone pass into coarse conglomerates. Had these, which are plainly a littoral deposit, been laid down at the foot of a pre-existing cliff of greenstone, they would no doubt have been full of fragments of this rock ; but though I made special search for such I did not find a single pebble of greenstone. Pebbles and even heavy boulders of quartz, schists, metamorphic slate and sandstone and granite, were common. It is possible, of course, that the greenstone has been brought opposite to the carboniferous beds by a fault, but the latter have certainly not been laid down against a cliff of it, and it is just as likely that the volcanic rock is a later intrusion through them as it is that a fault has taken place.

The Spring Bay coal-field also presents evidence of the intrusive character of the main greenstone masses, and of the fact that the bedding of the strata has not been greatly altered in inclination by their agency. Here the coal measures lie in a deep basin surrounded by greenstone hills, and again we should expect to find debris of the surrounding rock constituting the main portion of the sediments. The sandstones, however, show fragments of felspar and mica, which point rather to their being derived from granite or metamorphic rocks. More direct and conclusive evidence of the greenstone being intrusive is furnished by the bores made in the early part of 1891 with the diamond drill in various parts of this basin. The first bore, after passing through sandstone, struck greenstone at 117 feet. This rock was here fine-grained, but rapidly became harder and coarser in crystallisation as it was penetrated. Three and a half feet of a clayey rock lying on the greenstone appeared to be the product of alteration of its contact with the sandstones. The appearances to my mind consist much better with the theory of the greenstone being later than the sandstone in age than the contrary supposition. In the second bore the effects of alteration of the sandstones by heat became very marked at about 46 feet, though visible almost from the start, the shales being converted into flinty stone, the sandstone to brittle quartzite, and the felspathic sandstones to a hard greenish rock wtih vertical joints, not unlike greenstone itself in appearance. The alteration evidently increasing with depth, the bore was not carried down to the underlying greenstone. The third bore, however, bottomed on very dense aphanitic greenstone. In this bore the strata do not appear to have suffered alteration from the contact with the igneous rock. At Ravensdale, near Little Swanport, another bore was put down. This soon struck hard sandstones and flinty shales, and was abandoned in shale which had been altered to hornstone. The main mass of the greenstone was at only a short distance from this bore, and there can be little doubt that the alteration of the sedimentary rocks was due to contact with it. All through the district from Spring Bay to Bicheno dykes penetrating the sandstones are of common occurrence. Taking these in connection with the large mass of greenstone and the alteration of the strata proved by the above bores, it seems to me impossible to come to any other conclusion than that the greenstone is entirely younger than the period of deposition of the coal measures. This theory is to some extent corroborated by a comparison of the mineral composition of the Tertiary sandstones with those of the Mesozoic age. The former are highly ferruginous and clayey, as might be expected from their being mainly derived from the greenstone, while the coal measure sandstones are very free from iron.

I have discussed the relation of the greenstones to the sandstones at some length, as it is necessary to understand this question when considering the likelihood of finding coal. If my belief is correct that the igneous rock is all younger than the sandstones, it will follow that we may expect to find the coal measures varying very much in depth, altered considerably in parts, broken exceedingly, and penetrated in a haphazard way by numerous dykes. At the same time it is quite possible that large areas of coal may be found covered by superficial cappings of greenstone. I do not, however, anticipate that this latter occurrence will be frequent, as it seems probable that long-continued denudation has removed immense quantities of former superficial deposits, leaving us now the roots, as it were, of the great lava flows. It is most likely that where beds of sandstones are seen lying at the foot of greenstone hills they will not pass under the latter, but abut up against them, and be cut off by them.

The various localities on the western side of Oyster Bay where coal measures have been found will now be described in order, going northwards.

Lisdillon and Mayfield.—South of Lisdillon homestead there is found a patch of hard white sandstone, which appears to have been hardened and metamorphosed to some extent by contact with the surrounding greenstones. This sandstone is probably only a thin capping on the igneous rock, and is of no importance as probable coal-bearing ground. Between the Lisdillon and Buxton's Rivulets, and from the latter north nearly to the Old Man's Rivulet, there is a considerable stretch of the coal measures, but these are much broken by dykes of greenstone, and in parts highly metamorphosed. At the White Hill, near Lisdillon, and also on the Mayfield Estate quarries have been opened for the purpose of obtaining flints for metalling the road. These flint-beds are altered shales which have been silicified and hardened so as to become hornstone. The nearly horizontal bedding of the strata is clearly visible in the sections, and in one of the quarries rounded pebbles were visible in the altered strata. Strong vertical jointing and sharp conchoidal fracture characterise the hornstone beds. From their proximity to large greenstone masses the conclusion must be drawn that the latter have been the cause of the alteration. An interesting instance of the greenstone overlapping the sedimentary strata was observed in a small quarry about half a mile S. 27° E. from the road-bridge across Buxton's Rivulet. The lava rock was very much fissured by numerous vertical and inclined joints, which gave it a shingly character, and made quarrying very easy; and in the floor where the upper rock had been removed fossiliferous shales were showing. Similar shingly greenstone is again seen at Barber's Point, and there, too, the shales lie close to the foot of the promontory on the beach, and very likely run partly under it. Throughout the whole area signs of the proximity of the igneous rock are often apparent in the sedimentary beds, but nevertheless there are portions of these which appear not at all affected. Up Buxton's Rivulet above the bridge felspathic sandstones are found in the bed of the stream and in its banks for perhaps half a mile, and it is possible that coal might exist in this locality in some quantity. Another comparatively undisturbed patch of sandstones lies in the paddocks to the north-east from the Mayfield homestead, and can be examined in a small creek which runs out on to the beach opposite Christmas Island. An old shaft which was sunk many years ago in this part of the ground was not successful in finding coal, and has long been filled up. At the Old Man's Rivulet a small patch of sandstone is seen, and in this are some carbonaceous shales and small seams of very impure coal. Taking the Lisdillon and Mayfield district as a whole, the probability of finding payable coal is very small, and I would not recommend boring here unless operations further to the north should reveal valuable seams, when it might be worth while to ascertain if these existed under the little disturbed area of sandstone above mentioned.

Kelvedon.—Round Mr. Edward Cotton's homestead at Kelvedon, an area of some five or six hundred acres of coal measures is found, apparently unaltered by contact with igneous outflows. The sandstone is the soft felspathic sandstone which so generally accompanies our coal seams, and may therefore be regarded as a favourable indication of their probable existence. On the beach at low-water shales are visible, and from time to time blocks of highly carbonaceous shale and fairly good-looking coal have been found cast up on the beach. From an examination of some of these pieces I am of opinion that they are not lumps lost overboard from a passing vessel, and that they are probably torn from a seam cropping out below low-water mark; even without these, however, the undisturbed appearance of the sandstone beds and their considerable extent point this locality out as one very favourable for trial with the diamond drill. A bore on the cleared low spur about due west from Mr. Cotton's house would show very shortly whether there is any coal in the formation. It might have a very considerable extension seaward; if the drill is taken into the district this portion should not be left untested.

Bellbrook.—Opposite Bellbrook homestead the Wye River has cut through and revealed the typical felspathic sandstones and shales of the coal measures; the former containing in this instance much fossil wood, carbonised and silicified, and the latter numerous prints of grass-like leaves. The strata are dipping to the westward about one foot in ten. A short distance down the valley from the homestead a dyke of greenstone, ten to twelve feet thick, may be seen cutting through the measures and faulting them down on the eastern side, and about a chain lower the massive greenstone cuts the strata off altogether. In a small creek, known as Black Creek, running north-westerly from Bellbrook, sandstone shows for about a mile; the beds dip pretty regularly E.S.E. about one foot in seven, and in ascending the creek the lower beds of the series are exposed; no coal has been found in these. The lower beds are much more quartzose than the upper ones which show nearer the Wye River, and a good deal of silicified shale or hornstone is seen in the gravel of the creek. North and east of the creek hard sandstones are found on the top of a small ridge in close proximity to large masses of greenstone. The whole area occupied by the coal measures here is probably not more than 300 acres, and the greater part of this is not likely to be coal-bearing, as the sandstones seem to belong to the quartzose series generally found below the horizon of the coal beds. The strata are evidently much broken by dykes of greenstone, and even if coal were found, as it might well be, near the homestead, it is not at all probable that it could be worked over any extensive area or with any profit. The place is somewhat difficult of access by tramways, and several miles from the coast; it would be, in my opinion, waste of money to test this spot by means of the diamond drill.

Freestone Creek.—This place has been already referred to as showing that the strata could not have been laid down in hollows of the greenstone. The patch of coal measure rocks here found is of small extent, and so surrounded by high greenstone hills as to be practically inaccessible even if it did contain coal; this, however, I do not regard as at all probable, the strata most likely belonging to a horizon in the carboniferous system far below that of the coal. The beds dip down the creek faster than its grade and the section therefore exposed some thickness of them, but no sign of coal was observed. Coarse quartz grits, shales, and mudstones, containing coarse gravel and boulders of Silurian and Archæan slates, schists, and granites, are the principal rocks seen; strong vertical joints are seen in parts of the formation, probably due to the influence of the underlying igneous rock.

Riversdale to Glen Gala.—Mention has been already made of the extensive alluvial flats lying at the mouth of the Swan River, and of the fact that they are partly occupied by an older Tertiary formation which, with the recent alluvial gravels, renders it impossible to obtain information on the subject as to the nature of the underlying strata, and of the necessity of boring before definite conclusions can be reached as to these. The extent of the possible coal-field renders a trial of the ground by a diamond drill very desirable, although, as already pointed out, the probabilities are against the enterprise resulting in a profit. The best section is seen near Glen Gala, in the Swan River. Here the felspathic sandstone forms the bed of the stream for about a mile above Glen Gala homestead, though not plainly appearing all the way. Highly carbonaceous shale is often found washed up from the bottom of the river, and points to the likelihood of there being coal seams also. The malign influence of the greenstone dykes is well seen in the side of the river about half a mile above Glen Gala, the lower coarse quartzose sandstones being exposed dipping from 45° to 60° to the south, in close proximity to one of them, evidently having been forced up to surface by it. Both above and below this spot the felspathic sandstones in the river are lying nearly level or with only slight angles of dip, showing that the inclination of the strata alongside the dyke is abnormal. The sandstone formation extends westward from the river for nearly two miles, rising into a range of low hills. The most westerly beds are mudstones and sandstones highly charged with the characteristic carboniferous marine fossils, such as *Fenestella*, *Avicolopecten*, *Spirifera*, and *Productus*. The dip of the beds was nowhere obtainable, but from their succession it is probably easterly, these marine mudstones being much lower in the coal measures than the felspathic sandstones found further to the east. Any coal that may exist in this part of the district would be almost certainly confined to the flat land immediately west of the outcrops of sandstone in the River Swan. The best site for a bore-hole would be near the river. Between the flats just mentioned and those lower down the river there is a large dyke of greenstone which crosses the Swan at the bridge on the road to Bicheno, and connects the main greenstone masses to the westward with the large spur of the same rock which separates the valley of the Swan from the Moulting Lagoon. Down the river below this dyke the alluvial covering is so deep that the sandstone, if existing there, is not visible. Being found at Glen Gala and near the junction of the roads from Swansea to Campbell Town and Bicheno, it is most probable that it does exist. One or two bore-holes in these flats would be required to settle the question.

Comb End, Apsley Meadows.—For about four miles from Glen Gala the road to Bicheno passes over nothing but greenstone; but very soon after passing the summit of the range which is here crossed, coal measures make their appearance, and continue down the valley through which the road passes nearly to Apslawn. In the cuttings on the side of the road leading down from the summit to Comb End occasional carbonaceous seams are noticed, and prospecting would have a very good chance of discovering coal in this neighbourhood. Round Apslawn the greenstone has again come in, but the coal measures seem to be pretty continuous from Comb End to Apsley Meadows. Towards the north-east of the Township of Llandaff they are again crossed by the road. The strata showing at this point are the quartzose sandstones, which lie as a rule below the coal horizon. North of Llandaff the sandstones extend for perhaps two miles, rising into hills which are crowned with solid greenstone. A heavy talus of loose greenstone blocks has fallen away from the tops of the hills and completely conceals the junction of the two formations. The sandstones here rise to a considerable height, and in them several seams of coal have been discovered. A section is afforded by a small stream known as Barber's Creek, which lies to the north and north-west of Mr. T. Board's farm. This creek has eroded a rather deep valley, in which are exposed the sandstones lying under the talus of loose greenstone blocks. A little work had been done on some of the beds of co exposed in this section, though not yet enough to prospect them at all satisfactorily. The principal workin was on almost the highest part of the section exposed, at a level some 550 feet above the sea. Above thi point, though a few stones of sandstone in the creek indicate that the coal measures extend still higher, th loose greenstone becomes so heavy that nothing can be seen of the rock underlying it. About 10 chai above the workings the greenstone appears to be in solid masses, and from this westward the hills a entirely composed of this rock. It is possible that the coal measures extend under, or partly under, thes hills, but I am more inclined to believe that they will be cut off abruptly by the greenstone. The questio could be tested by a bore some 200 feet deep from the flat at the head of the creek, or by driving into th hills in the coal seams themselves. The hardness of the greenstone would render boring an expensiv matter, and there would be considerable difficulty also in getting a diamond drill up on to the flat.

The section exposed by the workings in the creek (an open cutting and two or three small pits) is followings, taking the beds in descending order:—

		ft.	in.	ft.	in.
	Felspathic sandstone			40	0
	Thin bands of shale and carbonaceous shale			12	0
A.	*Coal Seam.*—Shaly coal	0	2	4	8
	Dark stony coal	1	0		
	Hard black flinty band	0	6		
	Bright coal	1	0		
	Sandstone	0	1		
	Shaly coal	0	8		
	Hard silicious band	0	2		
	Bright coal	1	1		
	Shale			0	11
	Bright coal			0	2
	Grey hard fireclay			2	9
B.	*Bright Coal*			1	5
	Dark shale bottom			10 and more.	

Samples taken from the coal seams A. and B. from top to bottom of the beds, such bands as could picked out in working on a large scale being omitted, were analysed by Mr. W. F. Ward, Governme Analyst, with the following results:—

	A.	B.
Fixed carbon	44·4	49·8
Volatile at red heat	18·8	20·2
Mineral matter (ash)	33·4	27·0
Moisture	3·4	3·0
	100·0	100·0

The proportion of ash in these coals is too great to allow of their use under present market condition It is possible that by using a coal-washing machine a good deal of the stony matter might be taken out, b this is out of the question so long as there is a plentiful supply of good coal in the market.

The seams strike north and south, and have a dip to the west of 7 degrees. Below the above sea the bed of the creek is obscured for some three or four chains by fallen rock, and then another outcrop coal is met with; this is an impure coal with a few bright seams through it, and appears to be about thr feet thick, but has not been cut through so as to reveal it properly; the floor is a shale or dark firecla strike N. and S., dip to W. 5½°. No assay was made of the coal from this outcrop, as it was muc weathered and required to be cut into. Below this seam a thick bed of felspathic sandstone is seen in t creek bed for about four chains, when a small seam of coal 12 inches thick comes in under it; this is poor quality. The bed of the creek below this is obscured by fallen greenstone for some distance, and one part seems to lie in solid greenstone; but some 10 chains lower down yet another seam of coal cro out, this time about two feet in thickness, dipping slightly to the west, but not so much as the higher seam Some of this is nice bright-looking coal, but the outcrop should be cut into before the exact thickness a quality of the seam can be determined. This seam is about 130 feet below the top workings. There a probably other seams in the measures still lower down, but owing to the creek now having a flatter gra and being much filled with debris no more are seen for a considerable distance. About 200 feet above s level, however, yet another is exposed. On the top of this is about a foot of bad soft coal and shale, th there is 2 feet 1 inch of fair bright coal with a sandstone band half an inch thick in the middle, stri E. and W., dip to South 10°; this dip may be only local, the outcrop being probably a little disturbe Two chains lower down the creek the strata, soft shale and felspathic sandstone, are lying as nearly possible horizontally, from which we may infer that the coal seam would also be horizontal. An ass sample taken from this bed yielded to Mr. Ward's analysis:—

Fixed carbon	43·6
Volatile at red heat	23·4
Mineral matter	26·6
Moisture	6·4
	100·0

In some of the other small creeks near Barber's Creek traces of the above coal seams, or possibly of other ones, have been noticed. The measures here evidently contain a great many beds of coal, and it is not at all likely that those exposed are the only ones. It is very probable that if the creek bed were cleared down to the bed-rock in places where it is now choked with detritus other seams would be revealed, and borings might find others again below the lowest outcrop. There is a sufficient area of coal-bearing ground in this neighbourhood to make it worth while to make preliminary borings to ascertain if payable seams exist. As it would be rather difficult and expensive to take a diamond drill up to the highest workings in Barber's Creek, I would recommend that in the upper part of this gully, where the ground is steep and the bed-rock could be easily exposed by cleaning the loose stuff out of the creek, this should be done by open trenches. A small expense would prove about 200 feet in vertical depth of strata in this way. Having done this the lower strata should then be tested with a diamond drill. The prospects of finding payable coal here seem to me quite bright enough to warrant the expense of boring. Should a good seam be discovered a tramway about seven miles in length could easily be constructed to Bicheno, where I understand there is a fairly good shipping-place.

If any boring is done near Apsley Meadows it would be well to test the strata above Comb End at the same time, as the same seams are likely to be found at both places.

Neck of Freycinet Peninsula.—In company with Messrs. James and Frederick Lyne I made a very cursory visit to the country lying to the north east of the Moulting Lagoon, which was found to present several features of interest. Granite and greenstone, Tertiary, Carboniferous and Silurian strata are all found here, and indications of mineral veins are not infrequent. A belt of white quartz gravel of considerable depth extends from the head of the Lagoon northwards for some miles, and probably indicates the position of an older channel of the Apsley River. As there is much granite in the vicinity of this it is rather probable that gutters containing tin might be found below the surface gravel.

Tin has been found on the Freycinet Peninsula, but much to the south of this portion. The Silurian system is represented by a patch of slates and sandstones, forming a high ridge just at the neck of the Peninsula. Some quarts reefs have been noticed here, and one which I saw had a not "unkindly" appearance, but so far as I could learn no gold has been yet found in any of these. The formation being favourable for gold, however, it is quite likely that careful prospecting would discover its existence. Some small ironstone veins were noticed, and samples from two of these were assayed by Mr. Ward, but without finding any metal of value: their being found at all is an argument for further search for more payable ones. The granite formation which is largely developed from Bicheno down to the south of Half Moon Bay is seen again inland from Isaac's Point and in a small patch S.S.W. from Mount Peter, but does not occur plentifully in this part of the Peninsula, though largely found to the south of it. The Carboniferous system is represented by sandstones and fossiliferous mudstones and limestones of the Lower Marine Series. Near Isaac's Point a patch of coarse grits and conglomerates is found resting on granite, which is probably part of the base of the Carboniferous system. The pebbles in this conglomerate are of Silurian and Archæan and Granitic origin. Greenstone occurs at Mount Peter and again on the point opposite King Bay, at the mouth of the Moulting Lagoon.

From information gained in the district as to the lower part of the Freycinet Peninsula, I am inclined to believe that it deserves more attention from prospectors than it has hitherto had. A considerable quantity of tin has been obtained from time to time, and probably more would be found if search were made for it.

Shipping facilities.—Should payable seams of coal be found in the Oyster Bay district, the want of a good port of shipment would be very much felt. Not having made any examination of the possible shipping-places I can only speak of them from hearsay, but I understand that Bicheno is a fairly good port for steamers, and would be capable of improvement so as to be able to deal with the produce of the Seymour, Douglas River, and Apsley Meadows fields. Any coal found in the field at the mouth of the Wye River might be shipped at Swansea so long as the output was small, but if it should become important a railway would have to be built to Cole's Bay on the east side of Oyster Bay, which is said to be a really first-rate harbour. Coal at Kelvedon, Mayfield, or Lisdillon would, I fear, have to be shipped from the beach in favourable weather, or else taken to Spring Bay.

In concluding this Report I feel bound to say that great kindness and courtesy was shown towards me by the Warden of the Municipality and by numerous other residents of the district.

I have, &c.

A. MONTGOMERY, M.A., *Geological Surveyor.*

The Secretary of Mines, Hobart.

(No. 79.)

REPORT ON THE COUNTRY TRAVERSED BY THE ROUTE OF THE PROPOSED WARATAH-TO-ZEEHAN RAILWAY.

Geological Surveyor's Office, Launceston, 4th February, 1892.

SIR,

I HAVE the honor to report that, in pursuance of your instructions, I have visited the country traversed by the route of the proposed Waratah-to-Zeehan Railway, with the object of finding if it is likely to be mineral-bearing. In making this inspection, I have been very greatly assisted by the Great Northern Railway of Tasmania Company, who gave instructions to their survey parties to help me in every possible way, and provided horses and men when necessary. To Mr. John Provis, who accompanied me from Waratah to the Success Mine at North Dundas, and to Messrs. Anketell, Clarke, and Mitchell, of the Company's engineering staff, my best thanks are due for much assistance and very great courtesy. Without their help and guidance it would have been impossible for me to have seen more than a small part of the ground.

Two routes have been proposed for this railway, and partly surveyed. The first was that of the Government Survey of 1891, branching from the Emu Bay to Mount Bischoff Railway, about a mile from Waratah, and running across the Knole Plain and down the valley of the Coldstream and Huskisson Rivers, crossing the Pieman River just above its junction with the Huskisson, and then running southward through the Dundas and Zeehan Silver-Lead Fields to join the Zeehan-to-Strahan Railway. On this route very rugged country is traversed in portions of the Huskisson Valley, numerous deep gullies and high ridges having to be crossed. To find easier country a secoud route is now being surveyed. This leaves the Emu Bay and Mount Bischoff Railway about eight miles from Waratah near the crossing over the Hellyer River, and runs almost due south over open flat country for some 12 to 14 miles. Keeping on the watershed between the Huskisson and the Mackintosh Rivers, comparatively easy country for making a railway can be got down to the Pieman River, where this route joins the first one. The engineers have not yet, however, decided on the exact route to be followed along the watershed, surveys being now in progress to determine the best line. Having myself had some experience in railway surveying and construction, I may venture to express my opinion that a practicable route may be obtained without much difficulty. The dense bush which covers the ground is the great obstacle to the laying out of the line, entailing on the survey parties an immense amount of labour more than is required in open country.

On the present occasion, the time for my examination of the country being very limited, I devoted my attention to the portion lying between Waratah and the Pieman River, and did not visit the Dundas Silver-field further south than the Success and Owen Meredith Mines. On my former visit to this field, however, in October, 1890, enough of the country lying between the Pieman River and Mount Zeehan was seen to be sure that the whole zone traversed by this portion of the proposed railway is highly mineral-bearing. The development of the Dundas Field since then has been very great, and as far as the part of line from Zeehan to the Pieman River is concerned, there can be no doubt now as to the necessity for and success of a railway. The country north of the Pieman, on the other hand, has been as yet but very little prospected, and there is not the same assured support for a line. Until opened by the pack-track down the Huskisson Valley, and by Meredith's Cattle-track (now being marked through), it was almost inaccessible, and since the completion of these works a cessation of prospecting, owing to prevailing financial depression, has taken place, so that even at the present time very few prospectors have been at work. A fair amount of success has, however, been even now attained, several groups of sections having been taken up in the vicinity of discoveries of argentiferous galena and gossan, and it may fairly be expected that many more discoveries will yet be made.

The country traversed by both the trial railway lines for the first 14 miles from the Waratah Railway is of basaltic formation, forming a large plateau, to parts of which the names of Knole Plain, Netherby Plain, Racecourse Plain, and Hatfield Plain have been given. This basalt belongs to the series of Tertiary outflows which cover so much land in the northern districts of the Colony. It does not appear to be, as a general rule, a thick deposit, for wherever it is cut through by deep river gorges the older Palæozoic rocks are found beneath it. It is only in these gorges that any useful minerals may be expected to be discovered at first, though as time goes on it is quite probable that lines of lode, and possibly "deep leads," will be traced under the basalt. But as soon as the basaltic plateau is left the country passed over by both routes is of a highly promising nature, and will doubtless prove to be rich in minerals. From the southern side of the Netherby Plain to the Pieman River the Huskisson Valley Route passes over rocks so similar to those of the Zeehan and Dundas Silver-fields, and of the Whyte River and Heazlewood Districts, that there can be no doubt as to their all belonging to one formation. Very few fossils were noticed in the sandstones, but such as were obtained were all identical with forms common in the "fossil-cutting" on the Silver King Company's property at Mount Zeehan. The rocks observed were conglomerates, sandstones, slates, and limestones, together with serpentine rocks of intrusive character, quite indistinguishable from those met with on the now well-known silver fields of the Heazlewood and Zeehan. Sections of the strata are as yet unattainable, and the exact relationship of the different beds cannot be seen; but it is very noticeable that in going eastward from the Huskisson River over the watershed to the valley of the Mackintosh a similar succession of rocks to that met with in going ~~eastward over the~~ Dundas Range is encountered, crystalline schists, quartzites, and highly indurated coarse quartzite conglomerates being found in both cases as we go further inland. It may be years before the structure of the country is satisfactorily worked out, and any opinion now formed of it is necessarily of a tentative character; but I am inclined to believe that an axis of Archæan schists and quartzites runs northward from Mount Dundas in the direction of Mount Pearse, and that the Upper Silurian sandstones and slates of the silver-fields lie on the flanks of this. As to the position of the coarse conglomerates (composed of well rounded pebbles of variously coloured quartzites), which form the top of Mount Owen, Mount Zeehan, parts of the ridge between the Huskisson and the Mackintosh, and Mount Pearse, I am in great doubt, but am disposed to believe that they are resting unconformably upon the Archæan and Silurian formations.

In the Heazlewood, Zeehan, and Dundas silver-fields large masses of serpentine rock of igneous origin have been found, which have very probably exercised a great influence on the formation of lodes in these districts. These are intrusive plutonic dykes and bosses, and vary a good deal in lithological character, from a serpentinous greenstone to pure serpentine and schiller-spar rock. In the Whyte River field and in the road-cuttings on the Magnet Range their intrusive character is plainly shown by the marked alteration of the slates in their vicinity, which are often baked and bricklike or converted into hornstone. Many of the soft clayey rocks at the Whyte River which have been taken to be decomposed diorite now appear to me to be nothing else than weathered masses of this same greenstone. Some of the richest ore in the district has been found in these. The fact that the serpentine rock occurs also at intervals throughout the Huskisson Valley increases the amount of similarity between this and the proved fields. It occurs near the head of the Que River, on the ridge between the Huskisson and the Mackintosh, about nine miles north of the crossing over the Pieman River, and again about three-quarters of a mile north of this crossing. Loose stones of it picked up in the Coldstream River show that it exists also up this stream. South-east from the Parson's Hood, on the Wilson River, another occurrence has been recorded.

We have therefore in the country lying between the basaltic plateau near Waratah and the Pieman River all the most likely conditions for the occurrence of minerals; namely—very ancient sedimentary rocks, much folded and contorted, broken through by plutonic intrusions, and exposed to view by the erosion of very numerous deep valleys. Further, these rocks, both sedimentary and plutonic, are identical with those in fields lying both to the north and to the south of them, which have proved highly fertile in minerals. As already remarked, but little prospecting has been done in this area, yet several discoveries have been made, which are an earnest of many more to come when the country is better opened up. A description of some of these finds will serve to show that the prospects of future mining here are very good.

Just-in-time Claim.—On the eastern side of the Huskisson, and close to the river, a discovery of galena has been made which goes by this name. It is about a mile south of the crossing of the Que River by the pack-track from Waratah to the Pieman River. Several sections have been taken up in this vicinity. The discovery is quite undeveloped at present, the lode not even having been cut through. The outcrop shows a mixture of quartz, baryte, galena, and a little calcite, and the lode is evidently a strong one, over two feet wide at the least, and probably quite five or six feet wide. Its course is not altogether clear, but appears to be nearly north and south. No first-class ore is yet exposed, though a good deal of the stuff would probably be worth concentrating. The country rock is limestone and sandstone. Working facilities are good, as it will be easy to drive on the course of the lode right into a considerable hill. This is a discovery of some importance, and is well worth following up to see if richer ore may be obtained.

Lynch's Silver Falls.—Another discovery of galena has been made some two or three miles from the last named, in a small tributary of the Huskisson, known as Ross Creek. A waterfall 110 feet in height occurs in this stream, and on breaking into the face of the rock it was found to be a lode. The face of the fall is, in fact, the exposed "hanging wall" of the lode. The country rock is a somewhat angular quartz conglomerate or grit. The lode is a wide one, not less than 30 feet through, and strikes, as far as at present ascertainable, N. 10° E., dipping to the westward. It is largely composed of quartz, and a good deal of altered country-rock, and contains much greenish serpentinous matter and some baryte and calcite. Towards the hanging wall there appears to be a good deal of lode-slate and some limestone. There appear to be a good many slikensides in the lode-stuff, and from these and its often brecciated appearance it is probable that a good deal of motion of the country has taken place while the lode was being formed. Galena is scattered through the mass of the lode everywhere, but not to my mind in payable proportion so far as yet exposed. No work of any consequence has yet been done to open up the discovery, however, and it is quite likely that mining operations will reveal good shoots of ore. It would be advisable to cross-cut the lode from the foot of the falls, and then drive along its course, making frequent cuts into it as work progresses. This mine is admirably situated for cheap working, being easily opened by adits into the hills on each side of the creek, and having excellent water-power. It certainly deserves to be tested further.

Carroll's Reward Application.—About nine miles north of the Pieman River, on the track to Waratah, application has been made for a reward claim on a soft lode in serpentine country. A small hole has been sunk about seven feet, showing a wall of clayey decomposed serpentine, and about six to eight feet in width of lode-stuff composed of clay, oxide of iron, oxide of manganese, and quartz. The lode has not been cut through. It seems to run a little to the west of north, and a quantity of loose gossan in the vicinity probably belongs to it. I did not ascertain if any silver had been found in the lode-stuff, but from its close resemblance to the clayey and ferruginous outcrops of some of the Dundas lodes in similar serpentine I should judge it worth while to sink a little further on the lode to ascertain its value.

Sale's Application.—A section has been applied for on an outcroup of gossan in serpentine country about two miles north of the Pieman crossing. No work whatever has been done on this, and as it lies in a wet shallowish depression in the ground it is quite possible that it may prove to be nothing but a deposit of bog iron ore; still it is rather more probable that there is a lode in this vicinity, as the ironstone is found over a considerable distance.

Several sections have also been taken up on outcrops of gossan between the Huskisson and the Wilson Rivers, but I could not find time to visit these.

Farrell's Discovery.—An important discovery of galena is reported from the junction of the Fury an Brougham Rivers, which unfortunately I could not on this occasion spare time to visit, as it would hav taken two more days. The specimens shown to me by the prospector were very pure galena. Mr. Farre describes the country as limestone, and reports the existence of some large caves in it. This find is consequence as showing that the silver-lead bearing country exists to the east of the railway route as we as westward from it.

Silver Cliffs Mine, Waratah.—This mine is also an evidence of the northerly extension of th argentiferous area. It is situated within two miles of the Town of Waratah, in one of the deep gulli lying north of Mount Bischoff. The country rocks are metamorphic sandstone or quartzite, sandstone, an slate. Two lodes have been discovered, and are being worked. The main one, from which the mi derives its name, was found cropping out in a high cliff, the face of which was covered with galena. Su sequent work has shown that the lode is a fault fissure traversing the strata obliquely, and that the ha quartzite which forms the cliff has resisted denudation, while the softer slates on the hanging-wall side the lode have been removed. The face of the quartzite is very distinctly marked with strong horizont striations, a very unusual feature, which shows that the displacement of the country along the fault fissu took place almost horizontally, instead of in a more or less vertical direction as is usual. The lode-stuff o the outcrop consists of quartz with galena, blende, and some pyrites, and is from two to four feet in thic ness: slickensides are found through parts of it. Two adits have been driven to cut this lode, the low one of which has not yet reached it. The upper one was continued some little distance through the lo without meeting with any further lode-stuff, and then a drive was put in from it along the course of th lode. This has so far proved very poor, but little galena being found. In the end of the drive at the tim of my visit, however, a little more ore was coming in, and it is possible that the patch of ore met with o surface is just ahead. In this drive the footwall of the lode preserves the same hard, polished, and horizo tally striated appearance which is seen in the wall laid bare on surface. Several small veins of galena hav been found in another part of the face of the cliff, which seem to be running towards the lode, and a probably "feeders" to it. The results obtained so far underground have been very disappointing after th high expectations raised by the really good prospects on the surface, but it seems to me that there is n reason to despair yet of the future of the mine, and very probably as work proceeds further ore-bodies wi be met with. There can be no doubt as to the permanence both in strike and dip of so well-marked fissure. The second lode on this property runs almost at right angles to the strata and should cross th first-named—or more probably be faulted by it—on the hill behind the mining manager's house. A sha had been sunk fifty feet on this, showing a lode up to two feet wide of galena, antimonial galena, Jamesonit (feather-ore), carbonate of iron, blende, and quartz. Some of the ore was very regularly banded. Th lode has been traced some chains on surface, and appears to be a good and permanent one. Much of th ore from the shaft is of very good quality, and fit to be sent directly to the furnaces.

Mount Bischoff Silver-Lead Mines.—The existence of argentiferous lead ores in the vicinity of Mou Bischoff has long been known, and a company was long ago formed to work one of the veins containi them, but without success. These earlier workings, however, taken in connection with the Silver Clif mine, show that such ores may be looked for in this formation.

Timber.—Both railway routes, after leaving the plateau, pass through forest country. Much of th timber is of small value, but there is also a fair proportion of "stringy-bark" and "celery-top pine" tre that would afford valuable timber for mining and building purposes, while the smaller trees, such as th "leather-wood," "tea-tree," sassafras," and "horizontal scrub" are good fuel either for engines or fo household use.

Transport from Mines to Railway.—An important question for consideration in fixing the route this railway is that of the possibility of bringing in feeders to it in the shape of tram-lines, roads, and aeri tramways. It is clear that the business done by the railway must depend greatly on the possibility gaining access to it. Between the Pieman River and Zeehan I do not think that there is much to be feare on this score, the route following low-lying ground and being easily reached from most of the mines whic lie near to it. In the choice of a route between the Pieman and Waratah it seems to me, however, th careful consideration of this question will be necessary, for parts of the country are so rough that it mig often be necessary to make a very long detour in order to reach the railway. It has been pointed out th the Archæan schists and quartzites seem to lie in a line between Mount Dundas and Mount Pearse, an that the country most similar to that of the proved silver-fields lies to the westward of this line—that i up the basin of the Huskisson. While it is extremely likely that the old schists will be fertile in mineral gold being perhaps the most likely one to be found, yet the fact remains that such discoveries as have bee made are in the Silurian formation and on the Huskisson basin. Farrell's discovery at the Fury an Brougham junction probably indicates, however, that the silver-bearing formation recurs on the eastern sid of the axis of older rocks. The line of railway, if run from the Pieman Crossing up the valley of th Mackintosh and thence round the head waters of the Que River, would keep along the ridge of schists an quartzites; and should these unfortunately prove to be barren in minerals, this part of the line would hav to be fed by tramways running over the ridge into the Huskisson valley or across the valley of th Mackintosh. Ore would then have uphill haulage to the railway in nearly every instance. If, therefore, practicable line can be got down the Huskisson valley, it seems to me that it would be better policy t make it there than to sacrifice all considerations of feeding it to a perhaps lower prime cost of constructio Owing to the rugged nature of much of the ground there will necessarily be a good deal of difficulty i getting branch lines to mines at any distance whichever route is selected. As the country is explore however, it is likely that many as yet unsuspected routes for tramways will be found, and it is quite possibl that much of the anticipated difficulty will disappear. The luxuriant growth of tangled scrub and fore which now covers everything prevents good views of the country being obtained, and makes it perhap seem more difficult to traverse than it really is.

Older Discoveries of Minerals.—In estimating the mineral-producing capabilities of this District it uld not be forgotten that from time to time in years past the exploring parties who have penetrated it e reported the discovery of other minerals besides lead and silver. Gold has been found on the Wilson River, near the eastern base of the Parson's Hood ; a very highly spoken-of discovery of bismuth has been long known to exist at Mount Ramsay ; and tin ore has also been obtained. The last-named mineral has now been found in almost every place where granite occurs in the Colony, and as the country from Mount Livingstone to the Magnet Range is nearly all granite it is nearly certain that tin-fields will be opened up there. Particular attention should be given by prospectors to discovering further occurrences of the eurite and topaz-porphyry dykes which have undoubtedly caused the immense deposits of tin ore at Mount Bischoff, as it is very probable that this was not the only outbreak of the sort.

Prospects of the Railway.—In conclusion, I have to say that in my opinion the prospects of success of this railway are very good. It passes through a very large portion of the Zeehan and Dundas Silver-field in close proximity to a number of mines which now are putting out ore of excellent quality, and to a great many promising prospects not yet developed; it taps the north-western slopes of Mount Read and Mount Murchison, which have lately been proved to be promising gold-fields ; north of the Pieman it goes through a district as yet practically unproved, but still an evident extension of the Dundas Silver-field, and already affording undoubted evidences of carrying minerals ; and at Waratah it connects with the road to the Whyte River and Heazlewood fields—a very important feeder. There can be little doubt that the whole of the country between Waratah and Zeehan is destined before long to carry a large population, whose requirements will ensure good business to this line.

I have, &c.

A. MONTGOMERY, M.A., *Geological Surveyor.*

The Secretary of Mines, Hobart.

REPORT ON THE BEN LOMOND DISTRICT.

Geological Surveyor's Office, Launceston, 5th May, 1892.

Sir,

I have the honor to report having visited the Ben Lomond District, and made a general examination of the mineral areas taken up there for tin and silver mining purposes. My first visit to the district was from the 8th to the 15th of December, 1891 ; but as the Great Republic mine, the principal one in the place, was at that time full of water, due to repairs to the winding machinery being in progress, I again went to it on the 8th, 9th, and 10th of March, 1892. While sufficient time was taken to get a good general idea of the geology of the district and to fairly well examine the principal mineral-bearing ground, no attempt was made to lay down with accuracy the boundaries of the formations met with or to make any survey of the various lodes. A detailed examination such as would be required to do these things would consume a great deal of time, and does not seem to me to be at all necessary as yet, the amount of development done up to the present being very small. The general map forwarded with this report is therefore only a sketch one, to indicate broadly the general position of the various formations.

Topography.

The mines are all at the north end of Ben Lomond, lying on the slope extending from below the towering cliffs known as "The Butts," which form the highest point of the mountain, to the South Esk River at Avoca. From the valley of the Esk the ground rises rapidly to about 2200 feet above the sea level, at which height we come on a very noticeable terrace (*see* section herewith) of fairly flat ground of very considerable extent, reaching from the head waters of Gipps' Creek on the west to Story's Creek on the east, and averaging probably two miles in width. From the north side of this terrace the ground rapidly rises, getting steeper as we ascend, till on the talus of broken rock lying immediately at the foot of "The Butts" it is inclined at the angle of 30° to the horizontal. Finally, vertical cliffs up to 250 feet in height are met with, forming the northern edge of the table-land which lies on the top of the mountain at a height of slightly over 5000 feet above sea level.

Access.

A fairly good cart road has been made from Avoca to the Great Republic mine, and access from it to the other mining properties is pretty easy. It goes up the valley of the Castle Carey Rivulet, coming up on the terrace above mentioned on section 3520–87m. Here it crosses an old unformed road leading from the Rix Hill mines to those of Story's Creek. This old road connects near the Rix Hill mine with another track leaving the main road about four miles from Avoca and leading to the Ben Lomond, Great Republic, and Gipps' Creek mines, and to the Town Reserve lying at the foot of "The Butts." Between Avoca and the junction of the main road with this old track the ground is pretty flat, the valley of the Castle Carey Creek widening out and running flatter as it comes out on the flat valley of the South Esk.

Geological Formations.
Basalt.
Tertiary.
Greenstone.
Carboniferou

The township of Avoca is situated on a patch of basalt of probably Tertiary age and of limited extent. It is similar to the other Tertiary basalts found in this Colony and in Victoria. For about a mile along the Ben Lomond Road after crossing the Esk we pass over clayey and sandy beds, which I have not examined closely, but which are probably part of the Tertiary deposits which extend up the valley of the South Esk for a long distance. Next diabase greenstone is met with. This is portion of a very extensive mass which bounds the mineral-bearing area on its western side, and connects with the great cap or boss of the same rock which forms the table-land on the top of the mountain. The old road to Ben Lomond above spoken of runs along the contact of this greenstone with the granite and carboniferous formations next to be mentioned. About a mile and a half from Avoca sandstones belonging to the lower beds of the coal ite.

on-
us, &c.

measures (permo-carboniferous) are come upon, and the road passes over these up to its junction with the old track, where granite comes in. This is a porphyritic granite composed of felspar, quartz, and mica, all well developed, but with the felspar (orthoclase) in much larger crystals than the other constituents. It, however, varies a good deal in different places both in composition and texture. In some parts of the district, as near the Great Republic mine, and again on the main road near where it crosses the Buffalo Creek, masses of quartz porphyry are seen in which the felspar is not in recognizable crystals, but forms the groundmass in which the crystals of quartz are studded. Mica in these rocks is in small quantity, absent, or micro-crystalline. In the Great Republic mine the granite country, which as a rule is coarse-grained and of the usual ternary type, is in parts hard, dark-coloured, and fine-grained, with occasional very large crystals of orthoclase up to two inches in diameter. The colour of the ordinary country granite of the district varies from grey to reddish-grey, and in general it is very similar to the granites of Mount Cameron, Mount Stronach, the Blue Tier, and the Freycinet Peninsula, with which it is probably contemporaneous. It forms the main mass of the country rock between Gipps' Creek and Story's Creek, and goes northwards close to the greenstone capping of the mountain, and probably extends underneath it. It is overlaid in parts by strata belonging to the coal measure formation, slightly inclined shales, mudstones, sandstones, and conglomerates, often highly charged with typical fossils of the permo-carboniferous system. These are met with in various parts of the district: on the main road from Avoca at about 1400 feet above sea-level, and thence to the top of the terrace at 2200 feet, in patches over various parts of the terrace, and at intervals along the course of Gipps' Creek. At the foot of the greenstone talus below "The Butts," sandstones and conglomerates of this system are found pretty regularly, and for some 300 or 400 feet up on the talus, occasional, though rather rare, blocks of sandstone are met with, showing that there is probably a considerable thickness of these beds lying up against or running under the greenstone of Ben Lomond. In this instance it seems highly probable that the greenstone had overflowed the sandstone beds to some extent rather than cut them abruptly off, for the curious step-like terrace seen in the section was certainly till quite a recent period covered by permo-carboniferous strata, and the high greenstone escarpment of "The Butts" is most likely due to the rapid erosion of these soft beds from beneath an overlying sheet of greenstone.

From a scientific point of view the coal measure strata of this district are worth a much more detailed examination than I have yet been able to make of them, as it is probable that they afford a very complete section from the marine beds of the permo-carboniferous formation to the mesozoic plant beds of the upper coal measures of this Colony. Highly fossiliferous limestones are found in Gipps' Creek; the mudstones of the head of the Castle Carey Creek are also rich in fossils (marine); in the sandstones just north of Section 703-91M fragments of vegetable remains, too broken for recognition, were observed; in the mudstone conglomerate near the Story's Creek Company's small dam coaly fragments of plant stems were pretty plentiful, and higher up Story's Creek inflammable shale has been obtained; and, finally, at a height of about 4000 feet some seams of coal, with the characteristic mesozoic fern fossils accompanying them, have been discovered. Mr. R. M. Johnston also informs me that shales containing the characteristic glossopteris and gangamopteris of the lower coal measures have been collected near the head of Gipps' Creek. It would seem, therefore, that the section here revealed ought to give a fairly complete sequence of the beds from the base of the lower coal measures to at least the coal horizon of the upper coal measures. The interesting problem of the age of the Ben Lomond greenstone would probably be solved by a detailed examination of these occurrences. While there is a certain amount of evidence that the greenstone is younger than the permo-carboniferous formation, it is not so certain that it is also younger than the mesozoic or upper coal measures; and, as has been frequently pointed out, the relations of the diabase greenstones to the coal measures of this Colony have a most important practical bearing on the extent and value of our coal deposits.

The greatest thickness of carboniferous strata in this district is exposed in the patch at the head of the valley of the Castle Carey Creek. Here there are probably not less than 600 feet of them in vertical thickness. On the terrace, however, they appear to form only a very thin coating, through which the underlying granite has been exposed in many places. In the vicinity of the old Tasmania mine, for example, nothing but granite is seen, the coating of sedimentary strata having been entirely removed by denudation. Traces of the former presence of these beds at no distant time are, nevertheless, to be seen in many parts of the flat ground, even where no part of them is seen *in sitû*, the surface being strewn with waterworn rounded pebbles of metamorphic slate, quartzite, schist, quartz, and granite, which at first sight lead one to suspect that deposits of alluvial drift exist. They are, however, in reality derived from beds of soft mudstone conglomerate, small patches of which may be seen still undisturbed in various places on a ridge to the west of the old "Clunes" mine, near the Eastern Marsh, on the flat between Nesbitt's and Story's Creeks, and elsewhere. A very good specimen of them is to be seen in a shallow shaft sunk not far from the Story's Creek Company's small dam, just at the foot of the greenstone talus. Here the conglomerate appears as a hardly at all indurated mudstone, full of thoroughly waterworn pebbles of quartz, metamorphic sandstone, and granite, exactly similar to the rounded stones found scattered over other parts of the terrace. It may be here remarked that, though immediately under the talus of greenstone from the high cliffs of the top of the mountain, I could find no pebbles of greenstone in the conglomerate, which goes far to prove that the greenstone is of later age. In none of the other places where conglomerate was found could I find any pebbles of greenstone in it either, though, in most instances, close to existing large masses of that rock.

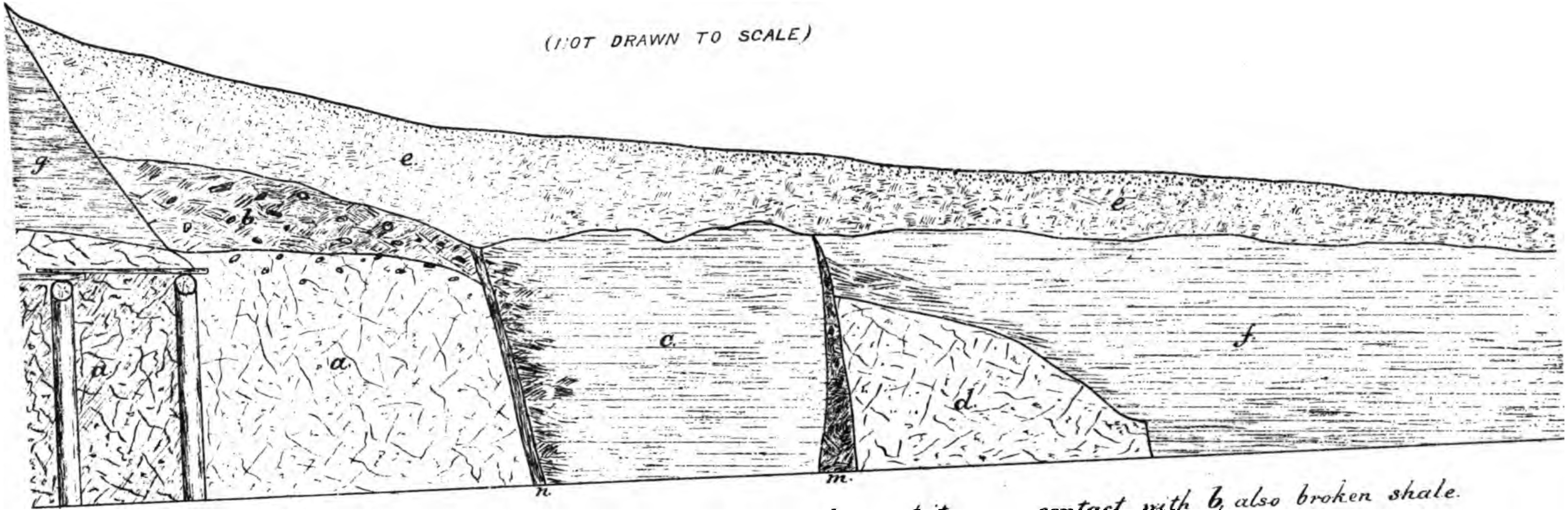
The elevation of the sedimentary beds to such heights as where we now find them has probably been performed by means of a series of faults. The sandstones found at the foot of the mountain are probably of the same horizon as those at the foot of the talus of greenstone below "The Butts," some 1700 to 1800 feet higher. Whether this dislocation was produced by one or by more than one fault no evidence has yet been collected to show, but, most probably, more than one would be required. A small fault is visible in an

SECTION

SEEN IN SOUTH SIDE OF APPROACH TO THE

BEN LOMOND ADIT

(NOT DRAWN TO SCALE)

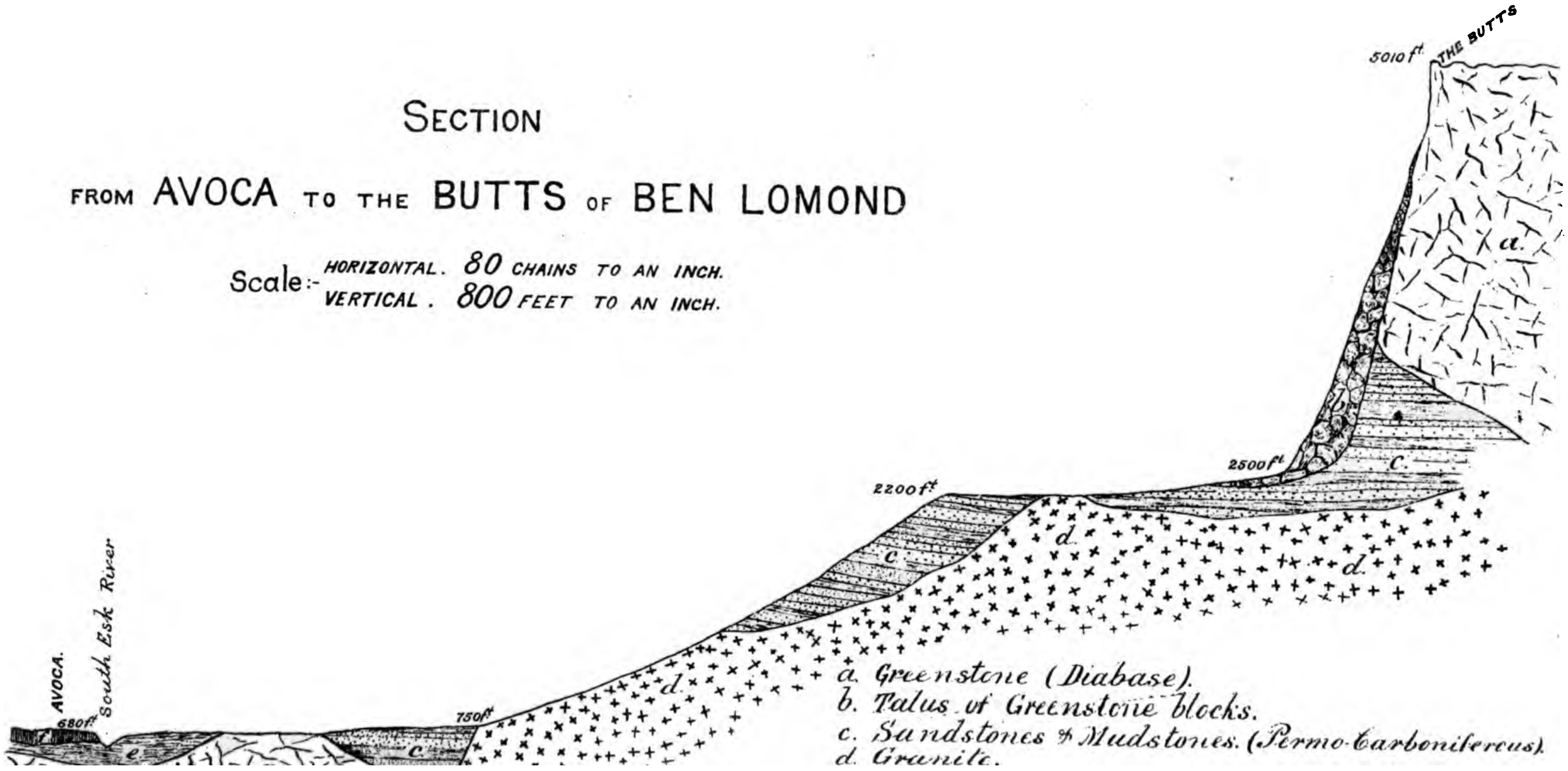


a. Granite, containing rounded pebbles of quartz and quartzite near contact with b, also broken shale.
b. Broken Shale, with rounded pebbles.
c. Shale, broken near contact with n.
d. Granite.
e. Surface soil, clay and gravel.
f. Shale, a little broken near contact with d.
g. Shale, seen over top of tunnel, same as c. and f.
m. Clayey contact mass, fragments of shale and blue clay.
n. Clayey vein at contact of a. and c.

SECTION

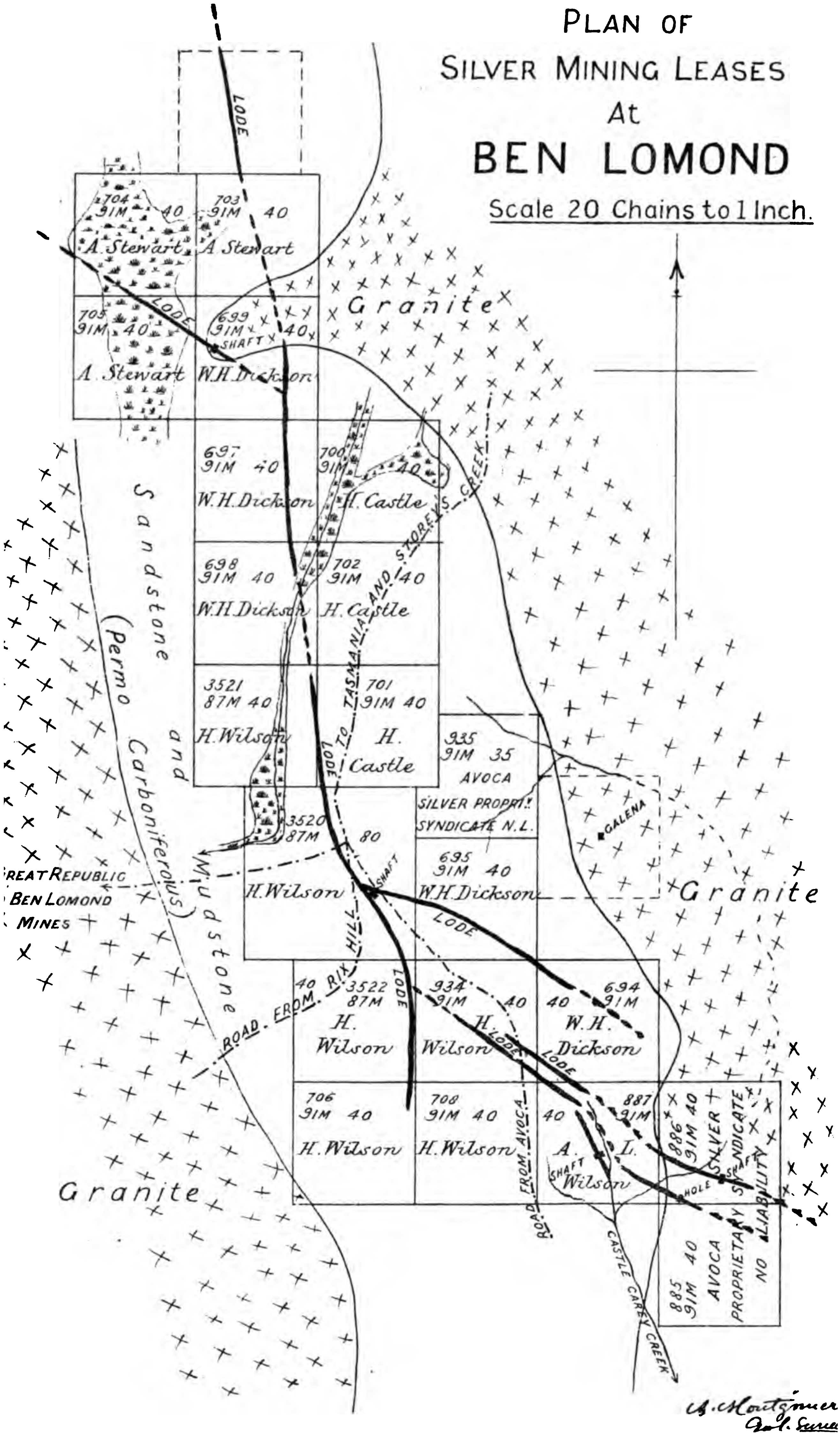
FROM AVOCA TO THE BUTTS OF BEN LOMOND

Scale:- HORIZONTAL. 80 CHAINS TO AN INCH.
VERTICAL. 800 FEET TO AN INCH.



PLAN OF SILVER MINING LEASES At BEN LOMOND

Scale 20 Chains to 1 Inch.



A. Montgomer
Geol. Surve

angle of the road leading up the valley of the Castle Carey Creek, near the bottom of the large patch of coal measures beds there existing: the sedimentary beds are seen to be cut short off by a nearly vertical granite wall. It is possible that the faults may have some connection with the mineral-bearing lodes of the district, and, even if not, they deserve study from a mining point of view, as being likely to cut off any lodes they may encounter in their course.

Silurian.

Another formation has yet to be mentioned before passing on to a consideration of the mineral deposits, namely, ancient metamorphic sandstones and slates, highly inclined as to bedding, and much seamed with quartz veins, found in the vicinity of the upper part of Story's Creek. No fossils were observed in these, but it is most probable that they belong to the same series as those further eastward at Mangana and Mathinna, and are of Silurian age. Silurian slates are also said to occur near the head of Gipps' Creek, a locality which I did not visit. Fragments of this formation are very abundant in the permo-carboniferous conglomerates above mentioned.

SILVER MINING AREAS.

A large number of mineral sections have been taken up for silver mining purposes between the head waters of the Castle Carey and Buffalo Creeks and near Rix's Hill. They fall naturally into two groups, those in granite and those in the permo-carboniferous sandstones. The latter are nearly all together in a group, at the head of the Castle Carey Creek, and are shown in the smaller plan accompanying this report, which is taken from one kindly furnished to me by Mr. Frank Reed from his own surveys. As shown thereon, several lines of lode run through the sections, and all are very similar in character. They are well defined, and readily traceable on surface for long distances, the outcrops frequently forming distinct outstanding lines of rock. By describing them in some detail their characteristics and probable value may be explained.

Section 3520-87M.—This and the adjacent Section 3521-87M are held by the Avoca Silver Proprietary Syndicate, of Melbourne. Two lines of lode seem to unite in the former section, and near their junction a shaft has been sunk to a depth of 88 feet in hardish mudstones and sandstones full of the characteristic fossils of the marine beds of the carboniferous system (*Fenestella, Protoretepora, Spirifera, Stenopora, &c.*). At the bottom of the shaft a drive was put in to the south-east a distance of some 16 feet, cutting the lode about 8 feet from the shaft. It consists mostly of rather spongy silicious oxide of iron (brown hematite) with a good deal of fragmentary country rock enclosed in it. A sample taken by picking a large number of small pieces of the lode-stuff from the heap on surface, was sent for assay to Mr. W. F. Ward, Government Analyst, in Hobart, but did not contain any metal of value. On surface the main lode is easily followed along the line laid down on the plan: it generally is very full of fragments of country rock, but in places is fairly free from these, and consists then almost entirely of siliceous brown oxide of iron. The outcrop varies in width up to 10 or 12 feet, and the lode, if opened, would probably be found to average 6 or 8 feet in width, or perhaps more. The trend of the lode is on the whole about N.N.W., and its underlay is only slight, and towards the N.E.

Sections 695-91M and 694-91M.—A little to the east of the shaft the second lode, shown on the plan as joining the first near it, crops out very plainly and may be traced E.S.E. through Section 695-91M into 694-91M. It consists of a breccia of fragments of the country fossiliferous mudstones cemented together by brown oxide of iron and some quartz, and often contains small crystals of quartz.

Sections 886-91M and 885-91M.—In these a change of country is met with, granite coming in. The junction of this with the fossiliferous mudstones is rather obscured by surface detritus through which the lodes are not clearly traceable; still two lodes which are well seen in the granite appear to be identical with ferruginous outcrops in the mudstone country in Section 887-91M, from which it would appear that they penetrate both sorts of rock, a fact which may prove to have an important bearing on the prospects of these lodes. Two small prospecting holes have been sunk in Section 886-91M, one about six chains south of the centre of the section, and the other near the south boundary about three chains from the S.W. corner. The former is said to be about 30 feet deep, but was full of water when I saw it. A lode about 14 inches wide, striking N. 55° W., underlying a little to N.E., consisting of a mixture of brown oxide of iron, quartz fragments, and siliceous cementing material, is seen here, and may be traced to the south-east to the top of the ridge on which the section is situated, and even further.

Tin is reported to have been found in this lode where picked up again farther to the south-east, but this I cannot vouch for. Samples for assay taken by me from the stuff at the shaft yielded no metal of value when tried by Mr. Ward. The second prospecting hole on this section is only a few feet deep; it reveals a large lode of quartz over six feet in width and of banded character, consisting of two bands of solid quartz one foot and two feet in thickness, with one foot of rubbly quartz between, and rubbly quartz again on the hanging wall. Dip S.W. about 76°. The quartz did not appear "kindly," and as far as I could learn neither gold, silver, nor tin has yet been found in it. About 20 feet south of this quartz there is a large strong outcrop of siliceous oxide of iron carrying some spots of white quartz. Loose stones from this and the quartz reef strew the slope down to the creek. Probably both belong to one large lode. Being in granite country the lodes in this section are to my mind better worth testing than those in the sedimentary strata. As the ground rises rapidly on the east side of the Castle Carey Creek, it would be easy to prove both of them by driving on their course from the creek level.

Section 887-91M.—It is possible that the lode being sunk on (February, 1892,) by the Castle Carey Company on this section, is connected with the last-mentioned lode. A shaft has been sunk on it to a depth of about 40 feet in veinstuff, consisting of fragmentary country rock, brown oxide of iron, and quartz. Water coming in too strongly when the level of the adjacent creek was reached, the work had to be abandoned.

The outcrop is very well defined, and strikes N. 25° W. In the shaft the underlay was found to be 1 in 15 to the north-east, and the width of the lode over four feet. The veinstuff was all oxidised right down to the bottom of the shaft. This lode being strong and well defined would be a good one to trace into the granite, which is not far distant from it, in order to see if it would be richer in metal in the more favourable country. In the shaft it has been worthless.

Sections 694-91M and 934-91M.—The two lodes shown on the plan passing through the S.W. corner of Section 694-91M are traceable as lines of loose stones of ferruginous brecciated material. The more northerly one is seen crossing the road as a line of ferruginous fractured country rock rather than distinct lode stuff, about one to two feet wide. Both seem rather small, and require to be trenched upon so as to be cut in solid country, and then prospected by sinking on them or driving in from the creek.

Section 699-91M.—Following the lode in 3520-87M northwards along its course, it is found crossing the road to the Great Republic mine as a band of ferruginous stained country rock, and is there traceable by loose surface stones into Section 699-91M, as shown on the plan. In going over this line I found it rather difficult to follow the outcrops, and it seemed probable that there was more than one line of lode, perhaps two or three close to one another and nearly parallel. The line on the plan indicates the general position of the outcrops.

Section 703-91M.—On the north boundary of Section 703-92M a very distinct outcrop of ferruginous lode-matter of similar character to those before described is met with, very probably belonging to the same line of lode or fracture as the foregoing, corresponding fairly well both in position and direction. The outcrop is traceable northwards for about 20 chains, and stands out boldly in several places. As a rule it is more ferruginous and contains less country rock than those hitherto spoken of. A large number of fragments from different outcrops were sent to Mr. Ward for assay, but did not contain any metal of value. The lode has not been worked upon at all, but appears to be from three to eight feet wide. The country is mostly hard mudstone and sandstone, with some conglomerate containing rounded pebbles of quartz and Silurian slates. A few indistinct impressions of plant stems were observed in the mudstones. I do not think that the permo-carboniferous strata are here more than 100 feet thick at the very most, as the granite appears quite close by. Here, too, it is most likely that the only hope of finding payable ore in the lodes is to follow it down into the granite country.

Section 705-91M.—On Section 699-91M a north-westerly lode has been discovered, and traced as on plan, into 705-91M. A tongue of granite here shows through the sedimentary strata, and a small shaft has been sunk almost at the junction of the two formations. The outcrops show the lode to be from 1 to 4 feet in thickness, but it may, of course, prove much larger when properly laid bare. The shaft was full of water, preventing examination. The lodestuff thrown out was mostly siliceous brown oxide of iron, containing no metal of value according to Mr. Ward's assay of the samples taken by me.

As will be seen from the above description, there is a great similarity in all these lodes traversing the permo-carboniferous mudstones and sandstones. They consist mainly of angular fragments of the country rock, cemented together by brown oxide of iron, clayey matter, and silica. The lodestuff is usually loose and spongy, and gives one the impression of having been formed at a comparatively recent date. There is no doubt that the lodes represent definite lines of fracture in the country rocks, and very probably, if opened up, it would be found that there is a certain amount of displacement in the beds traversed, those on one side being faulted down a greater or less distance. The lines of fracture having been loosely filled with broken country rock have been channels through which water carrying iron and silica in solution has percolated, depositing the present cementing material. Possibly, in the first instance, the iron was deposited as pyrites. Near the Great Republic mine, close to the track to Gipps' Creek, and on the Ben Lomond Company's property, pyrites and quartz lodes are found traversing granite, and these in their oxidised outcrops rather closely resemble the foregoing lodes.

In the prospectus of the Avoca Silver Mining Company, five assays of gossan from the lodes on the Company's properties are quoted, two of which gave good returns, 48 oz. 3 dwt. 16 grs. and 64 oz. 10 dwts. 8 grs. of silver respectively. The first was described as "quartz and iron gossan, with a little carbonate of lead," the second as "iron ore." During all my examination of these lodes I did not see one particle of carbonate of lead, nor did any of the assays of samples taken by myself, and analysed by the Government Analyst in Hobart, yield either lead or silver.

In the present unopened condition of the lodes it is hazardous to offer an opinion as to whether any metal of value will ever be found in them or not. The country rock in which they lie has not yet been proved to carry payable lodes anywhere in this Colony. Silver-lead lodes have been found in various parts of the world in strata much younger than our permo-carboniferous system, and there is no reason for anyone to say that it is impossible for these also to contain ore; still all the silver-lead lodes of this Colony have hitherto been found in the Silurian and Plutonic rocks, and very strong indications of the existence of the metals would have to be present before we should expect them in so much younger a formation. The most favourable feature, to my mind, in these lodes, is the almost certainty that they pass downwards into the granite. This has been proved to carry silver, lead, and tin in this same district, and it is quite possible, and not unlikely, that in it the lodes will carry these metals. The fact that the lodes above described also are on the whole parallel to the known metalliferous veins of the district leads us to have a certain amount of hope for their future, though it must be remembered against this that there is yet no evidence, except the similarity of strike of the sets of veins being contemporaneous.

Efforts have been made to form large companies in Melbourne to work these lodes, and a ridiculously high value has been placed upon them. If the money already spent in trying to float these companies and printing glowing prospectuses had been put into work on the ground instead, it would long ago have been proved if there was anything to mine for, a question at present extremely doubtful. I might sum up the prospects thus:—There are lodes, of fair width, definite and persistent over very considerable distances; it is very doubtful if any silver or lead has yet been found in them; they are in country rock which has hitherto never been found to contain silver ores in this Colony; they almost certainly go down into granite country, which has been proved to contain lead, silver, and tin in this very district; there is a certain amount of probability that in the granite they will contain these metals; they require to be prospected to find them; and the possibilities of finding ore seem to me sufficient to warrant a small expense in so prospecting.

Coming now to the ground taken up for silver-mining purposes in granite country, we find that the prospects are much more hopeful. Several of the sections once taken up have, however, been forfeited, and are not now held by anyone. Sections 935-91M and 695-91M comprise part of an old section 1637-87M, which has been given up. At the time of my visit a notice of application to lease 40 acres, due east and adjoining Sections 935-91M and 695-91M, was posted near an old working on this forfeited section. This hole was partly full of water and could not be entered, and the direction of the lode laid bare in it could not be ascertained with any approach to certainty. It is a large one, consisting of quartz impregnated with galena, blende, copper pyrites, talc, and fluorspar. The vein stuff is very hard, and, though some of it contains a good deal of galena, is, as far as seen, too poor to work. It much resembles some of the hard stuff in the Rix Hill lode. Though poor where it has been struck, it seems to me that this lode is well worth tracing and proving by trenches along its line of strike. It is highly probable that in places it will be found to contain more metal, and particularly tin ore. From the size of the lode as exposed in the cutting, it is probably not less than eight feet thick. A strong lode formation of this size may well be expected to prove permanent and, in parts at least, payable.

Abandoned Sections, 1971-87M, 1972-87M, 2062-87M.—On one or more of these forfeited sections a very interesting occurrence of galena is to be noted, namely, as an impregnation through granite. The rock is here almost altogether composed of felspar, quartz and mica being hardly at all distinguishable. The felspar is of whitish, pink, and greenish colour, with large porphyritic whitish crystals standing out from the mass, and the weathered portions are much blackened by dioxide of manganese. A hole about 20 feet deep has been sunk in the rock, proving it to be very hard, and likely to be expensive both to mine and to crush. Impregnated through the stuff is a good deal of galena with generally a large admixture of blende. This occurrence is of interest as showing the existence of lead in the country rock, though I do not think that any of the stuff so far exposed is nearly rich enough to pay for treatment. I could not detect that there was any dyke or intrusive mass of this very felspathic rock penetrating the ordinary granite of the district; it rather appeared to become more quartzose and gradually merge into the regular type. A little to the east of the shaft some softer rock has been cut in a shallow trench, and it might be possible to sink here more easily; but I am rather inclined to believe that the softness is only due to superficial and atmospheric influences, and will not extend to more than a few feet in depth.

Scott's Find.—Some 14 or 15 chains N. 15° W. from these workings the same galena-bearing felspar porphyry is seen again, though ordinary granite intervenes between the two places. Here, too, the rock seemed rather a felspathic segregation than an intrusive mass. A trench about five feet deep has been sunk on a soft portion of this by Mr. Scott, prospector, of Ben Lomond. The soft material excavated contains much talc or chlorite, partly decomposed felspar, oxide of iron, kaolin, and some quartz, and may perhaps prove to be part of a lode traversing the porphyry. On the joints crystals of cerussite (carbonate of lead) are pretty plentiful, and a good deal of galena is seen on breaking the more solid lumps. The appearance of the stuff is, however, deceptive, as it yields on concentration a much smaller percentage of galena than would be expected from looking at it. Some of the best-looking pieces collected by me were sent to Mr. Ward, Government Analyst, in Hobart, with a request that he would determine what percentage of concentrates could be obtained by washing, and their value. He reports:—"Sample B, after concentration by washing, yields galena and blende, &c., equal to 2·1 per cent., containing 23·8 per cent. of metallic lead, and silver at the rate of 11 oz. 8 dwt. 16 gr. per ton of concentrates. No gold is present in this sample." From this it appears that not only is the percentage of galena in the stuff small, but it is also poor in silver when obtained. The amount both of lead and silver is nevertheless very noteworthy for a country rock, and gives good hope of finding rich deposits in any lodes that may in time be found to traverse it. The attention of prospectors should be directed towards tracing any veins that may appear in the country round about into this proved metalliferous rock, which would be very likely indeed to enrich them greatly. It is also worth while finding out if the felspathic mass is or is not an intrusive dyke. Should it prove to be one, there would be considerable probability of finding contact lodes along its edges.

Rix's Hill Mine.—The most important discovery of silver ore yet made in the Ben Lomond District is on Section 1191-87M. Here blocks of galena weighing several hundredweights and of high assay value have been obtained. There has been much controversy as to the prospects of this mine and the direction in which the lode is running, and there is here a problem which requires well directed work for its satisfactory solution. A shaft and irregular open working have been made two chains south-east from the centre of the section, the open working forming an irregularly circular hole 8 or 9 feet deep and about 15 feet in diameter, at one side of which the shaft has been sunk to a depth of 33 feet from surface. From the bottom of the shaft some 15 feet altogether of driving had been done in different directions. The open working used to be drained by a deep trench, but this is filled up with rubbish and could not be examined, which is unfortunate, as it was likely to have thrown light on the course of the lode. The rock showing on all sides of the open working is lodestuff consisting of rather hard quartzose granular veinstone impregnated with talc or a hydromica, and some kaolin. Much cassiterite (tin ore) occurs through the stuff, and in the stone thrown out of the excavation I very soon picked out a large number of pieces that would be highly payable if obtainable in quantity. The tin ore is in fine grains, and generally appears to be richest where there is much green talc in the stone, specimens of which may be said to consist almost wholly of these two minerals. A little galena, blende, and copper-pyrites are occasionally visible in the veinstuff, but not enough to be of themselves worth more than passing notice. Running through this lode-matter, however, in flattish irregular masses are numerous strings and veins of hard glassy-looking quartz, often in very large crystals, and in this quartz, and more especially immediately round it, galena, copper pyrites, and black blende (marmatite) occur freely, and several tons of highly payable ore are reported to have been won from the workings, small as they are. Much of the copper pyrites is altered to and coated with indigo copper. A careful examination of the workings, and conversation with Mr. Briggs, who was at the taking out of the ore, led me to the conclusion that the veins of quartz and associated sulphides had no regular course, but lay in irregular patches of very variable thickness and extent through the rest of the lode-stuff. They are evidently of later formation than the bulk of the lode, bunches of talcose tin ore being often seen to be clearly cut through by the veins of glassy quartz. It seems evident that after the filling of the lode with quartz-carrying talc and tinstone it has been shattered and fissured, and the crevices have been filled with clear quartz and sulphides of lead, zinc, copper, and iron. The evidence of this later origin of the quartz and sulphide bunches seemed to me very conclusive. In the small drive eastward from the bottom of the shaft the country granite is struck, forming a well-defined almost vertical wall, separated from the lode-stuff by a clay selvage or flucan. The wall has a very slight underlay to the eastward, and strikes north and south, but has only been laid bare for about 4 feet in length. It is so well defined, however, that I have no doubt as to its being a true lode wall.

In order to cut the lode at a lower level, an adit has been driven 180 feet N. 21° E. through granite country to a point almost immediately under the shaft. The Mining Manager, Mr. Savage, told me that the adit was 65 feet below the top of the shaft, but according to my aneroid the difference is only 50 feet. The last 25½ feet of the drive are through lode-stuff similar to that seen in the open working. The western wall of the lode is struck at an acute angle, and, as the drive has been continued straight on, it passes diagonally across the lode, and not at right angles through it. The western wall is not quite so well defined as the eastern one seen in the shaft, the selvage not being so distinct. By observing the marked difference between the lode-stuff (which has, however, a somewhat granitic appearance) and the country granite the division is easily found. It strikes N. 10° W., and has a very slight underlay to the westward. The mean strike of the eastern and western walls as observable in the workings is, therefore, N. 5° W., and the lode can have little, if any, underlay. In this connection it is important to notice that lode-stuff of very similar character has been got in a trench seven chains north from the shaft, the line connecting it with the latter bearing N. 5° W. The surface of the ground being much covered with superficial granite debris, it is impossible to actually trace the lode from the shaft to the trench, but the bearing of the connecting line agreeing with the mean bearing of the walls of the lode, it is most probable that the latter continues right along it. The idea has been generally held that the course of the lode is about W.N.W. and E.S.E., but from the facts stated it appears certain that its course is only a few degrees to the west of north. The lode stuff on the western wall consists of granular quartz with talc and kaolin, carrying a little disseminated galena, marmatite, and pyrites, and very little tin ore. On getting further into the lode, however, much better tin ore was obtained, and the last 10 feet of the drive passed through some very rich stuff. Three or four tons of good ore were won here in making the drive. In the face, which has not gone far enough to cut the eastern wall of the lode, more marmatite and copper pyrites were showing at the time of my visit than had been met with previously, and it seems likely that on the eastern wall, which would be reached in a few feet further driving, more sulphide ore would be obtained. The owners, however, for some reason or other ceased working without penetrating to the eastern side of the lode. Measured at right angles to its course this must be some 16 or 17 feet wide. It is a very great pity that work was stopped without going a little farther. The quantity of tin ore in the stone is quite sufficient to justify going on with the driving; in fact, if the stone continued of the same richness it seemed to me, from such judgment as could be formed by the eye alone, without actually crushing and washing off large quantities of the stuff, that it was highly payable. With a wide lode like this, in solid country, working should be cheap; and though the adit commands only some 50 feet of "backs" at the shaft, going northward on the course of the lode the ground rises, and at the crown of the ridge—say six chains north of the shaft—there would be between 110 and 120 feet of "backs," and going over the ridge a deeper adit could be driven along the lode from the deep valley in Warner's section, 3365-87M. The stone in the trench before mentioned, seven chains north of the shaft, appears to be worthless; but the lode has not been cut through, and it may be as in the adit poor on one wall and good on the other. The quantity of tin ore seen in the adit and the open working makes me have no hesitation in saying that this lode well deserves a thorough trial, there being every reason to hope for a payable mine being the result. This, too, is having regard only for the tin, quite outside of any argentiferous lead ore that might be obtained as well.

About 50 feet N. 75° W. from the shaft another lode has been struck in a trench, a fact which has had much to do with the belief that the main lode ran W.N.W. and E.S.E. The strike of this is, as well as I could ascertain it from the short and rather poor wall exposed, N. 75° W., and it must, therefore, run against or pass through the main lode almost at the shaft. It appears to dip about 65° to the S.W., and consists of quartz and talc—very like the vein-stuff of the main lode—containing impregnated specks of galena and copper pyrites, but no tin ore as far as I could see or learn. The hanging wall is not seen, and the thickness of the lode is not, therefore, ascertainable, but it cannot be less than three feet nor probably more than eight feet. This lode may have some connection with another one found in section 1520-87M, towards the south-east corner of which some very good specimens of tin ore, composed of small crystals of cassiterite, studded through somewhat cellular and granular talcose quartz, have been picked up along a line running N. 65° W. The veinstone is very similar to that in the workings of the shaft and adit, but is more weathered. Most of the stones, though often very large, appear to be loose, and the lode, of which they are fragments, has not yet been cut in the solid ground; but there can be no doubt as to its existence in the near neighbourhood of the line of loose blocks. Hardly any work has been done in the way of trenching for

GREAT REPUBLIC MINE

SCALE 50 FEET TO AN INCH

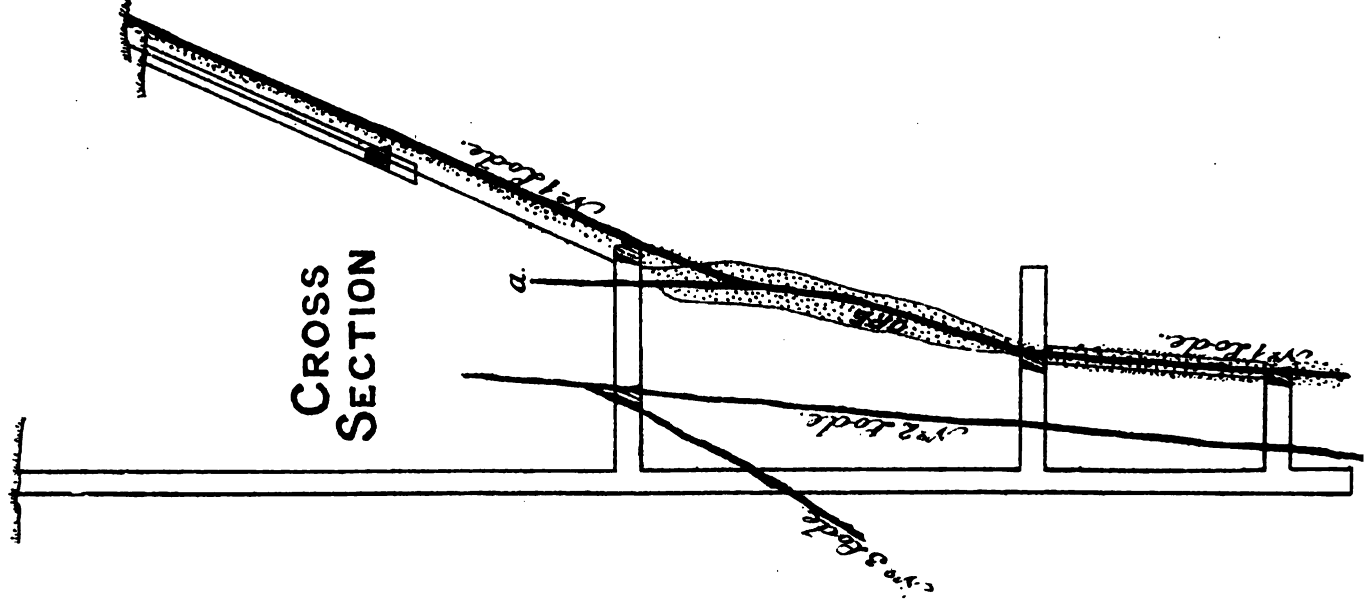


Fig. 40.

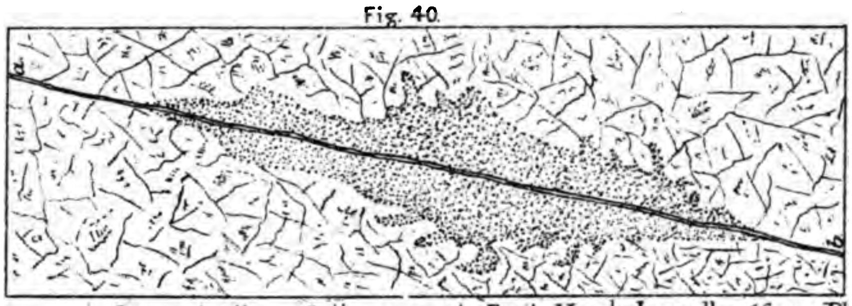
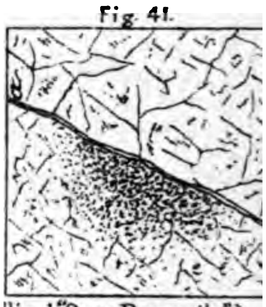
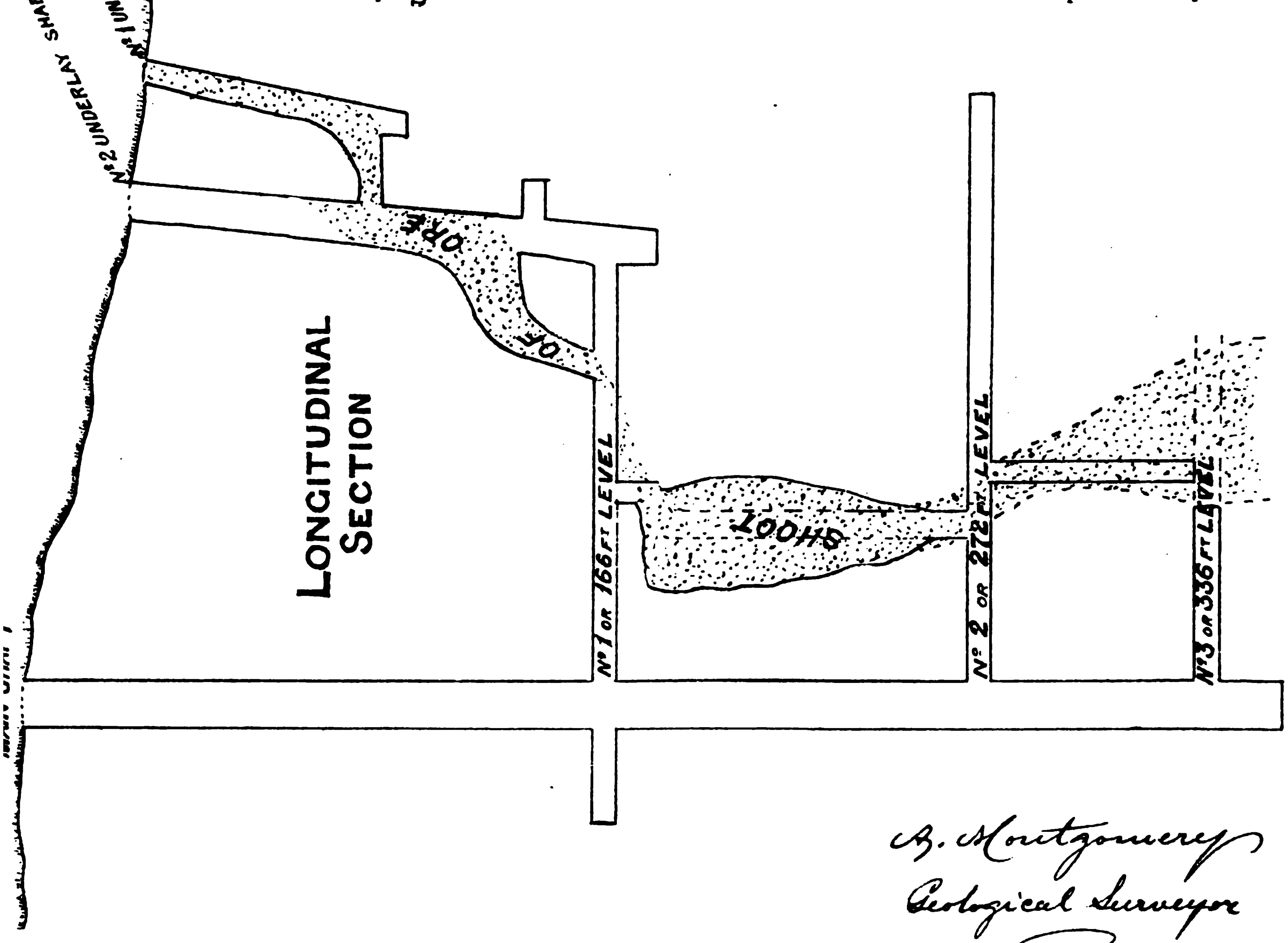


Fig. 41.



Impregnation of tin ore at East Huel Lovell. (from Phillips' "Ore Deposits.")

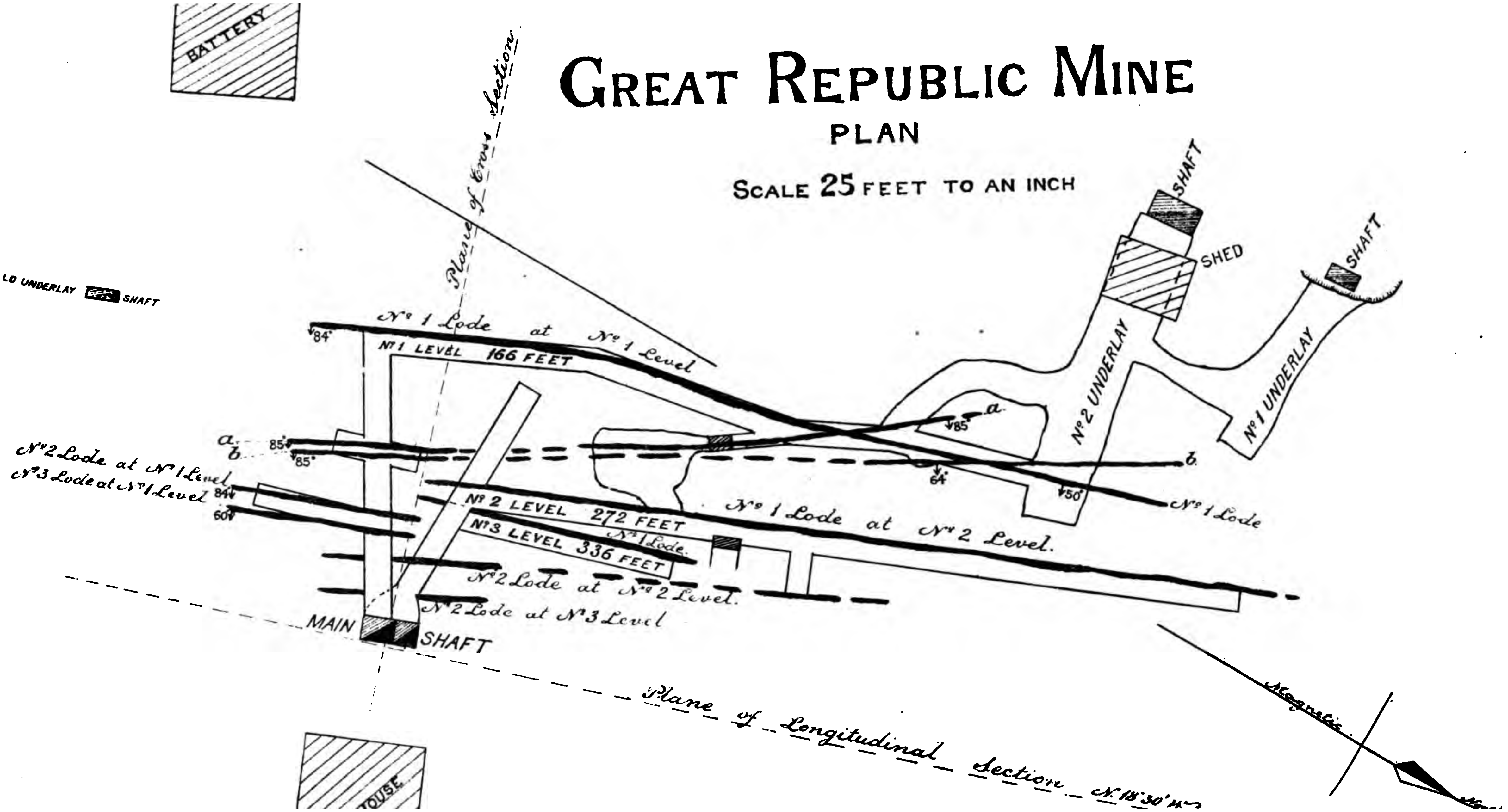


A. Montgomery
Geological Surveyor

GREAT REPUBLIC MINE

PLAN

SCALE 25 FEET TO AN INCH



this lode, which is surprising, as many of the specimens are rich enough to make it well worth searching for. The position of this lode is considerably to the south of where it should be expected, if it were the same as the foregoing cross-lode at the shaft; but there is, nevertheless, a good deal of likelihood of their being identical. If not, they must be approximately parallel.

A good deal more work will yet require to be done before it is clear to which of the lodes that run into one another at the shaft the silver-lead ores and other sulphides belong. As above remarked, the quartz veins carrying these sulphides in them and on their margins are very flat-lying, irregular, and variable. They seem to me, however, rather to run across the main lode than with it, and they may be connected with the cross-lode described, or it is even possible that there may be a third lode crossing and shattering both this and the main one. Efforts should be made to ascertain the relation; and with the mine in its present state, with the dead-work of driving an adit through the hard granite country all over, the action of the owners in abandoning work without seeing what was in the lode they had struck with so much pains can only be described as pusillanimous. Very little work is now required to definitely settle the question of the course of the lodes and the mode of occurrence of the silver-bearing sulphides. It would be advisable to continue the adit to strike the eastern wall of the main lode and then drive along it for some distance. A cross-cut should be put in to where the cross-lode strikes the main one, so as to ascertain if the two form a junction, or if one cuts through or is faulted by the other. Two or three months' work ought to be quite sufficient now to show if the mine is worth going on with, as there is every reason to believe it is.

C. R. Foster's Section, 3505-87M.—A lode of considerable interest is seen in this section, a few chains west of the Rix's Hill Mine. It is mainly composed of breccia, of country rock, sandstone, and slate, with occasional rounded pebbles probably derived from conglomerate beds, all cemented together by siliceous brown oxide of iron and kaolin. The fragments of country rock at this point are mostly derived from the permo-carboniferous strata, though I noticed also an occasional fragment of granite. The same lode is also seen again close to the old road at the head of what is known as the "Black Pinch," in section 1842-87M, where it contains a larger proportion of fragments of granite, as well as slate, sandstone, quartz, kaolin, and oxide of iron. I took samples for assay from Foster's section, but they proved valueless when tested by Mr. Ward. The bearing of the outcrop here is N. 15° W., but the lode appears on the whole to have a N.N.W. course, as it is said to be traceable for about ten miles along the contact between the diabase greenstones and the granite formation. The ferruginous outcrops are often 10 to 12 feet wide. What is probably part of the same lode is seen on the hill west of the old "Clunes" mine workings, but is there mainly made up of mudstones hardened by infiltration of silica. There can be little hesitation in classing this as a "contact lode" formed by the breaking of the diabase greenstone through the older formations. The presence of fragments of the sandstones of the coal measures in the lode-stuff in Foster's section and at the "Black Pinch" where these do not occur *in situ*, the country being all either greenstone or granite, goes to prove that they at one time overlaid the granite, and have been removed by denudation. If the lode owes its origin to the eruption of the greenstone, as is most probable, the presence of these sandstone fragments in such quantities in the veinstuff of this contact fissure goes far to prove that the diabase is younger than the coal-measure rocks. This lode is in its main characteristics similar to those in the sections at the head of the Castle Carey Creek previously described, and is fairly parallel to the main line of lode there. It is worthy of remark, too, that most of the lodes of the entire Ben Lomond District have a northerly to north-westerly bearing, whether carrying tin ore or otherwise.

Besides the occurrences of silver or supposed silver lodes above mentioned, there are reported to be several other ferruginous veins discovered in various parts of the district, some in granite, some in the coal measures, on which next to nothing has been done, and which I did not examine.

Tin Mining Areas.—We now pass on to a consideration of the ground taken up for tin-mining purposes, all of which is in the granite formation except the Sections in the neighbourhood of Story's Creek, many of which are on Silurian slates and sandstones.

The Rix's Hill Mine, which is much more a tin mine than a silver one, has been already described.

The Great Republic.

The principal mine now working in the district is that known as "The Great Republic," and is the most important as being the one which has yielded the largest quantity of ore and been sunk to the greatest depth. A plan and two sections (cross and longitudinal) of the workings are attached for the purpose of illustrating the remarks to be made on this mine. These, though approximately correct, are not altogether from actual survey, being taken as far as it went from a survey by Mr. G. T. Eddie in January, 1890, and brought up to date by means of rough measurements only, with hand compass and tape, which cannot pretend to accuracy. They are, however, sufficiently correct for the purposes of this report.

The ore cropping at surface was first of all worked by means of an underlay shaft, marked No. 1 underlay shaft on the plan. As this went down it was found that the ore was in the form of a pipe-vein and dipping southerly, and when a depth of about 67 feet had been reached No. 2 underlay shaft was sunk to work it further. In this again it was found that the ore continued to pitch to the southward, and it was recognized that a main winding and engine shaft was required. This was accordingly sunk ("main shaft" on plan), and at 166 feet a crosscut was driven towards the lode. In this drive four veins were cut before reaching the main lode, all running more or less parallel to it. The first was met with about 16 feet from the shaft, and is known now as No. 3 lode. It dips 60° towards the shaft, and passes throught it about 40 feet below this level. It is a small vein, and carries little (if any) tin ore where cut. At 21 feet from the shaft another small quartz vein, now known as No. 2 lode, carrying a little tin ore, was passed through. At 33 and 36 feet a pair of small veins were cut, and in the soft ground between them there was a little tin. These are marked *b* and *a* on the plan, and appear to be branches of the main lode. None of the veins above mentioned were of any magnitude, being practically only planes of division in the country rock coated with a little quartz, and often having the granite softened and decomposed along the sides of the fissure. The soft ground between the veins *a* and *b* is rather altered country than true lode-stuff. The main lode was met with in the crosscut at 58 feet from the shaft, and was driven along till connection was made with the underlay shafts. The ore in the bottom of the No. 2 underlay shaft still pitching southward, was met with about 105 feet from the crosscut and followed up by a stope to where it left the side of the shaft. The lode is a mere fissure in the granite, rarely more than an inch wide, filled with quartz, clay, and fluorspar. The walls are smooth, and often distinctly striated, showing the vein to be a true fissure on which motion of the country rock has taken place. Though the vein proper is itself so small, the wall rock is often much decomposed, the felspar and mica of the granite being changed to kaolin and talcose material, and this soft rock often contains tin. For mining purposes it really is the lode, being the part from which the ore is extracted. The main shoot of ore from which all the tin taken from the mine has come is all altered wall-rock highly charged with tin ores. At the bottoms of the underlay shaft and the stope southward from it the lode is crossed by two veins (seen on the plan), which are probably those marked *a* and *b* seen in the crosscut. These dip steeper than the main vein at this part of the mine, and must drop into it before reaching No. 2 level, as they are not met with there. The shoot of ore coming down through the underlay shafts and stope continued again below No. 1 level, dropping nearly vertically to No. 2 level. The best ore in this part of it began at the point where a winze sunk on vein *a* proved it to fall into and join the main lode. The veins *a* and *b* seem to be branches of the main lode only, and probably join it again, going both north and south.

At 272 feet a second level has been opened, a crosscut being driven 27 feet to the lode, and then a level extended along it 163 feet. No. 2 lode was cut in the crosscut 15 feet from the shaft, but was a mere fissure, and so was not followed. It has been cut again in a small cross-drive from the drive along the main lode, showing that going northwards it is getting nearer to it, and rendering it very probable that both lodes will junction if followed to the north. In this level, as in the top one, the main lode was very small, being nothing but a mere fissure filled with quartz, clay, and fluorspar. The ore shoot between Nos. 1 and 2 levels is very large and fine, but will be described at length presently.

A third level has been opened at 336 feet. In this No. 2 lode was cut 6 feet from the shaft, consisting of from 6 to 12 inches of soft granitic matter and quartz, but with no tin, and the main lode at 27 feet from the shaft. Where first struck this was again merely a fissure plane between hard walls, but going northwards soft rock containing ore came in on the sides of the vein, and the available tinstuff opened out to two feet wide at 19 feet from the crosscut. At the time of my visit a winze was being sunk from the level above in the ore-shoot, and the drive was nearly up to the bottom of this winze. In the face the lode-channel had opened out to 10 or 12 inches, but there was also good tin in the soft granite of the hanging wall. The winze went down all the way in good ore, and I have since been informed that the drive was continued on for over 40 feet, all in good tin ground. At this level the lode certainly looks better and shows more tin than in the upper ones.

The shoot of ore has been the feature of this mine from the very first. Mr. Moyle, the manager at the time of my examination of the mine, was not in it at the time when the two underlay shafts were sunk, and could not give me much information about them, but between Nos. 1 and 2 levels the ground was worked out under his directions, and was examined by me in company with him. The ore body followed down through the underlay shafts and stope became small where passed through by No. 1 level, but made strong again some eight or ten feet lower, where the vein *a* dropped into the main lode. From this downwards nearly to No. 2 level there was a splendid mass of ore which has been taken out, leaving a great cavity over 30 feet deep, about 30 feet long, and from 10 to 17 feet in width. The fissure vein in the upper part of this was wider than usual, being from 2 to 3 inches wide, and consists mostly of green and purple fluorspar and some quartz. Very fine specimens of fluorspar are here obtainable. The tinstuff itself is granite wall-rock softened and altered and impregnated with tin oxide. The granitic matter is talcose and contains much kaolinised felspar. At one part of the south end of the shoot it contained a great deal of black tourmaline in radiated spherical bundles, and where these came in the tin went out. In some places the soft tin-bearing granite was separated from the hard country by joints or walls, but in others no line of demarcation could be drawn, the ore-bearing rock gradually merging into barren stuff. About 30 feet above No. 2 level the shoot became narrow again, and was small where driven through, but the winze sunk to No. 3 level was in good ore all the time, and according to report it would seem that the shoot has widened out at the bottom level so as to be longer than it has ever been seen in the mine before. It is most probable that the origin of the shoot is as follows:—After the fracture of the country which formed the lode channel, the solutions carrying the tin found their way more easily along certain comparatively open parts of the fissure than along such as had been almost entirely closed by the falling together of the severed walls. These solutions caused decomposition of the granite and deposited the tin in this altered and softened rock. The shoot would then represent the course of the main flow of water through the lode fissure. The thick vein of fluorspar (thick as compared with the usual width of the vein proper) must have been deposited in an open fissure, and this wide part of the fissure would naturally be the main channel for the circulation of the water carrying the mineralising solutions.

The mode of occurrence of tin ore in the Great Republic Mine is very similar to one described by Mr. J. A. Phillips in his treatise on Ore Deposits, as will be seen from the following quotation and the copies of his figures annexed:—

"An impregnation of granite by tinstone which occurs at East Huel Lovell, in the Parish of Wendron, Cornwall, has been very clearly described by Mr. C. Le Neve Foster. Figure 40 represents a horizontal section of this deposit as seen at the 100-fathom level, in which *a b* is the *leader* or *divider*, a small vein composed of quartz and ferruginous clay, varying from $\frac{1}{4}$ to $\frac{1}{2}$ inch in thickness. The dotted portion is the tinstuff, outside which is the ordinary granite of the district. This granite is well marked and encloses large crystals of orthoclase, while the stanniferous portion consists of a mixture of quartz, mica, gilbertite, and cassiterite, with a little fluorspar, iron pyrites, copper pyrites, erubescite, copper glance, and chalybites. Gilbertite, a crystalline alteration product of felspar, is frequently abundant. There is no wall or selvage between the tin-bearing mass and the surrounding granite, the two gradually merging in to one another, and, following the leader along its strike, the tin-bearing rock decreases in width until at last both walls of the vein are composed entirely of granite. The shoot of tin at the 100-fathom level was about seven fathoms in length, the richest part having a length of three fathoms and a width of nearly nine feet. In some cases the oxide of tin lay entirely on one wall, as shown in figure 41, but the prevailing characteristics, namely, the leader of quartz, the absence of any wall between the tin and the granite, and the general composition of the tin ground, always remained the same. The main shoot of tin ore at East Huel Lovell has been followed from the 40-fathom level down to the 110 as one continuous pipe, and is in the shape of a long irregular cylindroid with an elliptic base generally about fourteen feet long by seven wide."

The ore in the Great Republic shoot has proved very rich, and if obtainable in larger quantity would make the mine a very profitable one. The ore is, however, unfortunately confined to this one shoot, as far as yet ascertained, the lode being outside of this too small and poor to be worked. As the shoot, though a strong and remarkable one, is of very small length horizontally, it has been necessary to do a great deal of dead-work for opening up a comparatively small piece of ground. Every successive level requires the main shaft to be sunk deeper, and crosscuts and drives to be made for a very considerable distance before the ore is reached. This large amount of dead-work is a severe burden on the mine, and unless other shoots are discovered, or the present one enlarges in depth, will probably lead to its eventual abandonment, even though good ore should continue to be found. That other shoots will be found by driving on the course of the lode is most probable, and exploration work to discover them should certainly be pushed forward. As there appears to be a tendency for the veins to come together towards the north, prospecting in this direction by extending the drives along the lodes is highly advisable. To the southward of the present workings it is not unlikely that the veins *a* and *b* will rejoin the main lode, and the junction may perhaps again form an ore-shoot. Should two or three more ore bodies similar to the one in the present workings be found, the mine would have a very promising future, but as long as all work is confined to the one shoot now in hand it can hardly be expected that much profit can result. The extension of this shoot in length at the No. 3 level is a favourable feature, and may be the beginning of a change for the better in the character of the lode generally. There is always a large amount of likelihood that a fissure vein, which is very narrow where first cut, will expand when worked on both in strike and dip, and as the regularity of the lodes in this mine, and the smoothed and striated appearance of the walls, point to their being strong lines of fissure, it is probable that wider portions will be found if looked for. It is not unlikely that both No. 1 and No. 2 lodes are branches from one lode, into which they will unite in depth.

Taking the proved richness of the known ore-shoot into account, as well as the probabilities of other shoots being found and of the veins coming together, and of the lode itself making wider when sunk and driven on, it is my opinion that this mine is a very genuine mining venture, and likely to prove a successful one. In its present position, however, it should not attempt to pay dividends out of any surplus realised from the good ore. So much has yet to be done to open up the mine, that if the ore pays for the dead-work the owners should be well satisfied for the present, and trust to get their profit from future developments.

The value of the ore in the shoot, which, it must be remembered, is the only part of the lode furnishing crushing-stuff, may be seen from the following figures :—

Between 11th December, 1890, and 1st December, 1891, 912 tons of ore were stamped for a return of 63 tons 18 cwt. of black tin, or 7 per cent.

In January and February, 1892, 90 tons of ore were crushed for 175 bags, or about 9 tons, of black tin, equal to 10 per cent.

Since the commencement of operations the product from the mine has amounted to 131¾ tons of black tin, for which in all about 1560 tons of ore have been crushed, the average yield therefore being about 8·4 per cent. of black tin, or very nearly 6 per cent. of metallic tin, the yield of the black tin averaging from 70 to 72 per cent. of metallic tin. The value of this is about £8420.

As showing how much dead-work has to be done in proportion to the ore won, it may be stated that during 1891 out of an average of 26 men employed only 4 were at work getting ore.

The mine has a 10-head stamp battery for crushing the stone, and two Frue vanners for concentrating it. The gratings have 82 holes to the square inch, and the battery crushes about 30 tons of ore a week, working eight hours daily, or at the rate of 1½ tons per head in 24 hours. The crushed material does not go directly on to the vanners, but first passes through three straight narrow buddles, each about 10 feet long, in which the heaviest ore is saved. This is dressed by hand by washing in another straight buddle or tie, the tailings from which go on to the Frue vanners together with the overflow from the first three buddles. This arrangement, by taking out a large portion of the heaviest tin ore, lightens the work of the two vanners, which would otherwise be overburdened if set to treat the stuff from 10 heads of stamps, containing 7 to 10 per cent. of concentrates. The vanners are driven by a belt from the cam shaft, a bad arrangement that ought to be altered, as the tables cannot be driven with the required regularity from the cam shaft. No assays are made of the tailings, a defect that ought also to be remedied, as it is most important to control the working of the dressing machinery by regularly testing the tailings to see that an abnormal per-centage is not being lost. The battery is driven by a 20 h.p. portable high-pressure double-expansion engine, by Marshall. A sister engine is used for winding. The battery and dressing appliances cannot be said to represent a good type of dressing machinery, but under the circumstances of the mine are probably as good or better than a more elaborate plant. More room is badly required in the battery, working being very much cramped, but it serves very well to test the mine. Should the Great Republic become a large concern, a better style of dressing machinery and a larger plant would require to be erected. Classification of the crushed material, the first requisite for successful concentration, is at present ignored altogether.

Ben Lomond Mine.—No work is being done now on this property, and the expensive mining and ore-dressing plant erected is suffering much from disuse, woodwork being rotted, split, and warped, and iron-work eaten with rust. I was unable to examine the underground workings owing to the shafts being full of water, and the long adit partly fallen in and half-full of water also. It is not possible, therefore, for me to say very much about the prospects of the property, Some four or more lodes are known to exist in it. No. 1 is near the main shaft, which has been sunk to work it to a depth of 100 feet. The lode strikes N. 37° W., has an easterly dip, and is said to have averaged about 3½ feet in thickness. About 1½ chains N.W. from the main shaft a small shaft has been sunk on the lode to a depth of 80 feet, and about 50 feet

N.W. from this there is another 80-foot shaft. These two shafts are in my opinion unnecessarily close to each other, the exploration work done by the second being more easily and cheaply done by driving from the first one. The lode-stuff lying about these shafts is a rather hard, talcose, quartz, micaceous in parts, also white quartz with pyrites. Fluorspar is pretty common, and some tourmaline also is found. Not much tin ore is visible, but presumably any good stone extracted has been sent to the battery.

No. 2 lode lies to the west of No. 1, and strikes N. 22° W., dipping easterly. On this there is a surface excavation, 40 feet long, 15 feet wide, and 12 feet deep, from which I was told that 38 tons of tin ore had been extracted. In the bottom of the cutting the lode appears as a small vein of quartz and quartzose granitic matter, showing little or no tin, and enclosed in hard country. The rich pocket was in soft granite, and when the hard country came in the ore died out. The vein is very well defined in the bottom of the excavation, and from its former richness ought to be worth sinking on in the hope of finding other similar rich bunches. The ore-bearing stuff is now of course all gone, but from the description of it given to me it seems very probable that it was softened and altered granite impregnated with cassiterite, similar to what is found in the ore-shoot of the Great Republic mine, and the experience of this would lead us to expect it to be found to continue downwards. Practically no search has been made for it below where the ore cut out, a winze sunk a few feet on the vein being hardly worth mentioning. It very often happens in ore-shoots that there are blank spaces beneath which the good ore again makes.

A few feet westward of the excavation are some thin quartz veins, striking N. 22° W.

Between the lines of No. 1 and No. 2 lodes, and about 1½ chains from the line of No. 2, is a lode carrying a great deal of tourmaline, striking N. 25° W., and dipping vertically, or with perhaps a very slight underlay to the westward. The vein where cut shows 12 inches of almost solid tourmaline rock, with the tourmaline in interlacing radiating needles, and 12 inches of quartz mottled with bunches of tourmaline.

No. 3 lode is about 1½ chains west of No. 2, and is cut in a drainage race from the excavation at No. 2. It consists mostly of felspathic matter, with some tourmaline.

No. 4 lode is perhaps one chain further west, and consists of micaceous quartz carrying a little visible tin ore.

Westward again from this is a lode of iron pyrites and quartz about two feet thick, running N. 25° W., and dipping easterly at a high angle.

It will thus be seen that a series of parallel veins have been cut on surface, and to cut them underground an adit about 750 feet long has been driven on a course N. 57° E. A fall of the roof had dammed the water back in this, and prevented me from going into it more than about 100 feet. The adit is some 105 feet below the outcrop of No. 1 lode. As far as I could learn, very little driving has been done on the lodes either from the shafts or from the adit. I could not ascertain how much stone has been crushed, but was given to understand that the quantity was quite small, the surface excavation on No. 2 lode furnishing the greater part of it.

At the mouth of the adit a 10-head battery has been erected, furnished with classifiers, jiggers, and ties as tin-saving appliances. The whole building is now in very bad order, the woodwork being very much warped and shrunk, so much so that the dressing appliances would have to be entirely renewed before doing any work. They could not have been very efficient in the first instance, for, though fairly good so far as they went, there seems to have been no adequate provision for the treatment of the fine sands and slimes.

This mine is a standing example of a mistake which is far too common, and which ruins many promising ventures. The capital of the company has been spent on building a battery and doing dead-work of one sort and another before proving the mine itself. If I have been correctly informed, the main shaft was sunk before the adit was driven, and it would have been an easy matter to prospect Nos. 1 and 2 lodes from the shaft to the same depth as is commanded by the adit. It would have been better to do this prospecting work from the shaft before driving the adit. If it had proved satisfactory the construction of the tunnel would have been very desirable, as it cuts through the whole system of veins, provides a way to the battery, and drains the mine to a depth of over 100 feet. If the adit had been made before the main shaft was sunk and provided with winding engine and pumps, the mine would have been proved to the same depth as now without any necessity for these. Hence, so far as testing the mine to a depth of 100 feet is concerned, either the main shaft and its machinery or the adit is altogether superfluous. Had the mine proved a good one both would have been doubtless required, the shaft to work the ground below the adit level. But all the available money was spent in building the battery, erecting winding and pumping machinery, sinking shafts, and driving the main tunnel, and at the end of all this nothing was left to look for the tin with. Had the money used for the battery and driving the adit been expended in driving on the lodes from the main shaft a great deal of exploratory work could have been done, and it is very probable that the mine would have been in operation to this day. The lodes are strong and well defined on surface; some of them have been in parts very rich in tin, and there is very reasonable hope that payable shoots of ore would be found in them if they were explored. The amount of work done underground is so small that their value cannot be at all regarded as disproved, and it is likely enough that it may yet be a very profitable investment. As the lodes can now be driven on from the adit at small expense, it seems to me that prospecting them would be a very legitimate risk. The experience of the Great Republic mine in finding the ore concentrated in rich shoots is very likely to be repeated in this and other mines throughout the district, especially as there is reason to believe, from the parallelism of the Ben Lomond, Great Republic, and Gipps' Creek lodes, and from their similarity in easterly dip and mineral contents, that they all belong to one system of contemporaneous fissures, and are therefore likely, according to the experience of mining districts all the world over, to have many features in common and be very similar in their behaviour.

In the approach cutting to the Ben Lomond Company's adit shales belonging to the coal measure series of rocks are exposed, and the section is of peculiar interest as showing features that lead to a suspicion that the granite itself has been intruded into the sedimentary strata. As this point has considerable geological importance, a sketch section of the occurrence is attached. On the south side of the approach, just at the mouth of the adit, the granite, *a*, which is of the usual type common throughout the whole district, contains imbedded in it rounded pebbles of quartz and quartzite. Immediately above the granite the shale is very much broken and displaced, and contains similar pebbles to those enclosed in the granite. The surface of the latter at the contact is full of broken shale and rounded pebbles. It is also clear from the section that either the portion *c* of the shale has been faulted down between the masses of granite *a* and *d*, or that the latter have been pushed up through the shales. The shale above *d* is a little broken, though not so much as over *a*. In the shale, the beds of which lie very flat, I found carbonaceous markings but no distinct fossils, and a good many pebbles of quartz and quartzite. Though the surface of the granite is much decomposed and softened, it seems hardly possible that pebbles could have been actually sunk into it for a distance of two or three feet, and the explanation that seems to fit the case best is that the granite masses were intrusive, and in pushing their way up through the shales absorbed portions of the latter, but could not absorb the pebbles of nearly pure silica contained in them. Against this theory has to be placed the fact of the crystals of quartz and felspar in the granite being as large and well defined at the contact with the shales as anywhere else, and that the shales, though broken at the contact, are not hardened and metamorphosed, as they would probably have been by a plutonic intrusion. The presence of fragments of granite in some of the mudstones of the permo-carboniferous series proves conclusively that some at least of the granite was in existence as a hardened rock before the shales were laid down; for, from their lithological character, the carbonaceous workings found in them, and their horizontal bedding, there can be little question of the latter belonging to the permo-carboniferous formation. Until further evidence is available a satisfactory explanation of the section will probably be wanting.

Gipps' Creek.—An interesting system of lodes is seen in the valley of Gipps' Creek in a small branch stream running through Sections 3116-87M (R. Bennell), 3118-87M (Gaunt), and 2650-87M (Gaunt and Foster), and also in Sections 2338-97M, 2309-87M and 2308-87M (all in the name of A. Mayne), known as the Long Tunnel Company's Property. Near the junction of the branch creek with the main one in 2650 87M, a good deal of ground sluicing has been done and very fair tin obtained. A number of fairly parallel veins bearing between N. and S. and N.W. and S.E. have been exposed in the bed rock by this work, all dipping easterly. They consist of quartz with a great deal of tourmaline and some wolfram, and occasionally tin ore. Splendid specimens of tin ore in quartz, but little waterworn, have been found in sluicing, and pretty plentifully, but no lode of corresponding richness has yet been struck. As the veins are seen in parts to contain tin it may be that the rich specimens are from patches in these, but I think it is more likely that they are derived from lodes higher up the little creek. A few chains above the alluvial workings a trench has been sunk on a lode of quartz and tourmaline running north-westerly. A few stones of white quartz containing wolfram were lying about the hole, but I saw no wolfram in the lode, which is hereabout 4½ feet in thickness but not well exposed. About half a chain north-west from this a number of narrow veins of quartz running close to and parallel to each other and bearing N. 20° W. have been laid bare, dipping about 45° to the eastward. The quartz is highly charged with tourmaline, but I also got some specimens with nice tin ore in them as well. These veins are probably part of the 4½ foot lode or else are parallel and close to it. A short tunnel across them into the hill at this point would give valuable information. The tourmaline in these veins is very similar in occurrence to that in the tourmaline lode in the Ben Lomond property previously mentioned.

The sluicing work shows that the small creek is running almost upon the bed rock and for prospecting purposes it would be very easy to carry a trench right up to its bed across the line of the whole lode system. In winter when water is plentiful this work could be very cheaply done by its aid: any lodes crossing the creek would then be laid bare. The specimens obtained in sluicing are so tempting that more work should certainly be done to try and find the lode from which they have come, and as it is clear that there are a number of parallel veins running across the creek there is no easier way of prospecting them than by stripping its bed right up. Should valuable lodes be found the ground is sufficiently steep to allow of their being well tested by means of adits without winding and drainage expenses. The owners cannot be congratulated on their enterprise in working those promising sections, which have been held for four or five years and practically nothing done on them.

In the *Long Tunnel* mine work was at a standstill at the time of my visit, and had been so for a long time. A good deal of mining work has been done, and at least three distinct lodes have been cut. From their position and course these probably belong to the same system of veins as those described in Gaunt, Bennell, and Foster's Sections. On the north boundary of Section 2858-87M an underlay shaft has been sunk on a lode 2 feet 3 inches thick, striking N. 10° W. and dipping easterly 50°. This is a very well defined lode with distinct walls. The veinstuff is mostly quartz, somewhat granular, and containing hydromicas and talc, and shows a somewhat banded structure in parts. A very fair amount of tin ore is visible in it, and in the stuff extracted and lying at surface the tin seems to be in payable quantity. A vein of copper pyrites about two inches thick with rich tin ore in close proximity is seen in the sides of the shaft. This, after following the lode down for some 20 or 30 feet on the underlay, was sunk vertically through the footwall to connect with a tunnel that has been driven for the purpose of cutting the lode. This tunnel, however, before reaching the tin lode, struck another one composed of barren quartz, which was driven along presumably in the belief that it was the lode sought for, until it was proved to be a different one by the sinking of the aforesaid vertical winze from the underlay shaft. This quartz lode runs N. 10° W. and dips easterly about 1 in 1, and must therefore be almost exactly parallel to the tin-bearing one both in strike and dip. The tunnel would probably have to be extended some 50 feet past the quartz lode before striking the one seen in the shaft. Another shaft has been sunk on the tin lode to the south of the line of the tunnel, but being full of water could not be examined. The material thrown out of it shows a very fair quantity of tin ore. This lode seems well worth giving a practical trial, and by extending the adit to cut it this could easily be done.

In the south part of Section 2358 a long tunnel, from which the mine takes its name, has been driven from the side of Gipps' Creek to a total distance of 560 feet. The roof having fallen in at about 300 feet from the mouth, I could not examine more than half of it. The first 200 feet are through country rock, on a course N. 10° W., then it veers round to about N. 12° E. for about 80 feet, when a small lode running N. 10° W. and dipping easterly 50° to 60° was met with, and the drive continued northwards along its course. This is probably a parallel lode to the one cut in the north of the section. As the adit is driven exactly on the course of the system of lodes, it has nothing like the same prospecting value as a crosscut would have had. It would have been far better after driving into solid and settled country to have driven crosscuts east and west across the strike of the lodes, and then driven on these as they were picked up. The lode found at about 280 feet from the entrance was probably never more than from 30 to 40 feet to the east of the tunnel all the way, and it was only through changing the course that it was struck. I certainly think that crosscuts should be driven from this tunnel if value is to be expected from the expense of making it.

Near the western boundary of Section 2358-87M a lode has been struck in two or three trenches and a shaft (now fallen in). Some pretty good tin is seen in the stone. The vein is said to have been from 18 inches to 3 feet wide in the shaft. Course N. 10° W., dip easterly. An adit has been commenced to cut this lode, but was discontinued after going 75 feet without reaching it. As this adit, if continued, would have cut all the lodes pretty well at right angles, it is a pity that it was not driven instead of the long adit. Both are on much the same level.

It will be seen from the above account that a great deal of work has been done without result. Of the three tunnels driven, aggregating about 1000 feet in length, none have reached the lodes proved on surface to contain tin. Both the tin-bearing lodes are well worth trial, and could be easily tested without much further expense. Their easterly dip is rather troublesome, as it makes the adits required to reach them much longer than if they had been vertical or dipping westward. The non-success of the former company should not be allowed to prejudice this mine in public estimation, for the prospects are neither better nor worse than before they started operations, all their trouble and expense having done nothing to prove the lodes, though they have made it easier for some one else to step in now and do so.

The Long Tunnel adit is about 400 feet below the plateau, on the western edge of which the Great Republic and Ben Lomond mines are situated. It would therefore be possible to do a very large amount of prospecting by driving eastward at right angles to the average course of the lodes. At least two groups of lodes are known to exist between Gipps' Creek and the eastern boundary of the Great Republic Company's ground,—viz., those of the Long Tunnel Company's and Bennell, Gaunt, and Foster's sections, and those of the Ben Lomond and Great Republic Companies' ground. Between these two groups there may be, and very likely are, others parallel to them. The strong lode of the Rix's Hill mine further south shows that the north-north-westerly to northerly system of veins is persistent over a long distance in strike. It is therefore possible that if a real " long tunnel," say 8000 feet long, were driven in from Gipps' Creek a large number of lodes would be cut by it at depths up to 400 feet. By coming lower down the creek to a point west of Section 1651-87M an adit could be got from 700 to 750 feet below the plateau. This would probably, however, begin too far to the east to cut the Long Tunnel Company's group of lodes. Water-power for driving machinery for compressing air and haulage could be easily and cheaply obtained from Gipps' Creek. In the present undeveloped state of all the mines it would be premature to undertake any such extensive scheme of work as this, but should the district turn out well it would be practicable, and indeed necessary. It is not at all outside the domain of practical mining to contemplate the possibility of driving right through to Story's Creek, a distance at the most of five and a half miles. At their nearest points the streams are only four miles from each other.

Story's Creek.—A large number of sections have been at one time taken up near the head of Story's Creek, but at present next to no work is going on, and many of the leases have been forfeited. On the Story's Creek Tin Mining Company's property (Sections 2141-87M, 1089, and 1077, held in the names of J. C. Genders and R. Bennell), one, and sometimes two, men are kept employed. Far more work has been done on this Company's ground than on any of the adjacent holdings, and it will be alone described now. The country is different from that in which the previously described tin lodes are situated, being in highly inclined metamorphic sandstones of probably Silurian age instead of in granite. The latter, however, is not far distant, being found in Nesbitt's Creek on the west, and on the east on the ridge between Story's Creek and the head of the Aberfoyle Rivulet, and probably the Silurian formation is also underlaid by it at no great depth.

A great deal of surface-work has been done on these Sections, the soil, though very shallow, having often contained large quantities of tin ore. So good are the prospects of loose tin that there seems at first sight every reason for the high estimation that has been held of this property by the owners and many others who have visited it. It is very reasonable to believe that where there is so much loose tin on surface, evidently from its angular and little abraded nature not carried far from the parent veins, there are good lodes beneath, and this belief, though not yet borne out by the results of the underground work performed, can by no means be regarded as overthrown, as it may well be that the rich veins have not yet been discovered. An examination of the numerous veins laid bare, however, is apt to modify the good opinion formed by looking at the loose tin alone, as it shows that there are numbers of quartz veins, mostly too small for profitable working, carrying bunches of very rich ore. The wearing away of these under atmospheric influences would have the effect of releasing large quantities of tin ore, and it might well turn out that, instead of there being one or more good lodes in the country that have supplied the tin, there are a large number of small and poor ones, unpayable as a rule, but bearing rich little pockets of ore. Going over the veins that have been exposed it would be very easy to pick out large numbers of most excellent specimens, but to take the general lodestuff as it comes to hand, it would not be payable. The tin ore is generally in large coarse crystals or aggregations of crystals, forming bunches in hard white quartz. Many miners look upon such occurrences with disfavour, regarding stone with the tin ore finely impregnated through it as much more permanent, while the coarsely crystalline ore in rich patches is considered likely to exist in only small quantity.

Without making a regular survey, it is hard to say how many separate lodes are exposed in this property. The surface-workings are on flattish ground, forming part of the terrace which extends to Gipps' Creek, though cut off from the main part of it by the valley of Nesbitt's Creek, a small tributary of Story's Creek. The underground workings are from the deep gully of the latter creek, and I am not certain as to the connection of the three or four lodes seen there with those exposed on the flat ground higher up. Where there are so many similar lodes or veins, careful tracing and pretty accurate surveying would be required to establish the identity of a lode seen in two or more places at considerable distances from each other. In the northern portion of the surface-workings several leaders of white quartz from 3 inches to 6 or 8 inches wide are seen, all running between N. 30° W. and N. 40° W., and dipping westerly about one in one. These appear to belong to a system of parallel veins lying close together rather than to definite lodes. They often contain rich patches of coarsely crystalline tin ore, especially on the edges of the quartz veins: wolfram is also very frequently seen. The quartz, as a rule, adheres fast to the metamorphic sandstone or slate country, and is not divided from it by a flucan or selvage. These veins have very nearly the same strike as the beds of the country rock, but appear to cross them in dip. About two chains to the east of these veins, on the brow of the slope leading down to Story's Creek, an open cutting has been made into a place where several veins of quartz have been cut close together. The main vein runs about N. 50° W., and dips westerly 60°: it is about 12 inches thick, and contains a good deal of wolfram. Several flat-lying veins, dipping westerly about 30°, and from 8 to 12 inches thick, are seen making into the main vein: some of them carry patches of tin ore, much of it resin-coloured, and generally adhering to the outside of the quartz veins.

Going a short distance to the south of this cutting along the brow of the gully an undeveloped quartz lode running north and south is met with, and following it southward two others parallel or nearly so to it are also seen, all three lying close together. The north-westerly and northerly veins must form a sort of network in some portions of this ground. The quartz veins are all similar to those above described, hard white quartz with occasional bunches of coarse tin ore. Belonging to the north and south series of veins mention must now, however, be made of another occurrence which is of a more promising character, found towards the south end of the surface workings. This is a very flat-lying vein of soft clayey matter, much stained and mixed with oxide of iron, and containing a good deal of tin ore, being in streaks very rich. The strike as far as now ascertainable is N. 5° E., dip westerly about 15°. From quite a small hole sunk on the outcrop 16½ bags of tin ore were obtained by sluicing the soft lode-stuff, the tin ore being crystalline, and not in any way waterworn. About a chain to the south of this, where the flat vein appears to junction with one or more of the other lodes, another small hole yielded 10 bags of tin. (A bag of tin ore weighs about one hundredweight). This occurrence being all in the somewhat broken surface rock, and not in solid settled country, is not quite clear as to its nature, but it is probably a very flat lode, two or three feet thick. The amount of tin seen in it makes it well worth further prospecting, especially as its character is more favourable for tin than the hard quartz lodes. I regard this as the most promising feature of the property, and one that ought certainly to be worked on so that more definite knowledge of it may be obtained.

The underground workings consist of levels driven from the valley of Story's Creek about 100 feet above the level of the stream. The main level is driven along the course of a lode of white quartz, 2 to 4 feet in thickness, carrying a few patches of tin ore and a good deal of wolfram. It has well-marked walls with clayey selvages, and varies in strike from N. 17° W. to N. 32° W., dipping westerly about one in one. The level has been driven some 300 feet along the lode, the latter being a good deal split up in the face where work has been left off. About 120 feet from the mouth of the tunnel a crosscut has been put in to the eastward, and at about 60 feet another lode of quartz is cut, after passing through which the crosscut has been extended to about 300 feet without further discoveries being made. This second lode is from one to two feet wide, strike N. 17° W. to N. 20° W., and dips westerly 35°. It has been driven on to the northward, and one or two stopes have been taken out on it. The walls are well defined, the quartz being separated from the country by a clayey selvage. A little tin and a good deal of wolfram are visible in the stone. At the mouth of the tunnel about 15 feet west of the main lode another small parallel quartz lode has been cut, but not further worked on. Throughout these workings the quartz is hard and white, and the tin ore when it does occur is concentrated into coarsely crystalline bunches. The wolfram is also in patches, and a great deal more abundant than the tin ore. As far as can now be seen the lode-stuff extracted must have been very poor.

The same mistake made by the Ben Lomond Company has been repeated here, a battery having been put up before the ore was in sight to keep it going. It has been well built, but is now falling into serious disrepair. There are ten stamps, a pair of spitzbitten, one 3-sieve jigger, one shaking-table, and several ties. The motive power is derived from a 32 ft. overshot water-wheel, the water for which is brought down by a pipe from a race which comes over the terrace, and is supplied from a dam higher up Story's Creek. A turbine or Pelton water-wheel, under the circumstances, would have been a much more efficient motor, as well as cheaper and simpler. The ore from the tunnels can be run directly on to the feeding-floor of the battery, and this being built on the slope of the hill very little handling of material is required. The mill being well placed for working the ore from the present levels, it is perhaps rather unfair to criticise its location, but it may be pointed out that a lower adit could be put in to cut the lodes from the level of Story's Creek 50 or 60 feet below the battery, and if the mine went ahead this would have to be made. The mill would then have to be moved, or the ore lifted to it. It seems to me that it would have been better to have put the dressing-floors lower down the creek; the stone from the present levels could then have been sent down to it by a shoot, the ground being steep enough for this to work well, and at the same time the ore from the low-level adit could have been brought along a level grade. Probably quite 60 or 70 feet more head or pressure could then have been obtained from the race to work a water-wheel or turbine, with consequent large increase of motive power.

Leaving out of consideration the further prospecting of the soft flat lode above-mentioned, which ought to be done in any case, and dealing only with the quartz veins, it seems to me that before giving them up as hopeless it would be worth while ascertaining if they passed into the granite country at a reasonably accessible depth. The granite may be regarded as the source of the tin in the overlying Silurian formation, and should the lodes, as is likely, pass down into it at no great depth, there is a very considerable probability of their being much richer in the more favourable country. A large quantity of tin, taking it altogether, certainly exists in the upper parts of the lodes, but so much scattered as not to be payable, and, as this is almost certainly derived from the lower granite, the presumption that the lodes will improve going downwards has a good deal in its favour. It would be interesting to find out if any of these lodes can be traced into the granite along their strike, and if any dislocation takes place at the contact of this and the Silurian formation. The lodes dipping westward at a flat angle towards the granite which appears in

Nesbitt's Creek only a short distance to the westward, it is possible that valuable knowledge could be gained by boring with a diamond drill at a point where the lodes might be expected to be struck at a depth of 600 or 700 feet, there being a likelihood of their then having passed into the granite.

Tasmanian Tin Mining Company.—In going to Story's Creek from Avoca we pass through the sections formerly held by this company and a number of others. The ground has been abandoned for years, and the scrub is beginning to cover the old trenches and workings. The Tasmanian Company had a main shaft, winding and pumping machinery, and a tin-dressing plant, but after a very little underground work the flat tin-bearing vein which had been the basis of expectations failed, and the mine stopped. The machinery was sold off, and much of it is now lying rusting on the hill above the Story's Creek battery A great many old trenches and small shafts are to be seen all over this ground, but from the stone visible now the prospects do not seem to have been very good. In a trench about six chains north-east of the old main shaft a lode formation is seen, three or four feet wide, striking N. 57° E., and carrying a little tin with a good deal of tourmaline. The lode-stuff is talcose soft granitic matter, some of it hardened by infiltration of silica, with a little clean quartz. I have been informed that very good prospects of tin can be obtained on parts of Egan's Freehold, Lot 882, but as this is private property no mining can be done. The granite country in all this neighbourhood is favourable for the occurrence of tin lodes, and this part of the district may come to the front again at any time with new discoveries.

Summary.—To sum up as to lode-mining in the Ben Lomond District it must be first of all said that the amount of development done is not at all commensurate with the large amount of money that has been spent on the mines. With the exception of the Great Republic and Story's Creek mines hardly any work has been done on the lodes; there has been a great deal of fossicking about and scratching the surface, a great deal of work begun and not finished, much premature erection of machinery, great expense in all sorts of ways, and consequently the investing public have lost faith in a field which absorbed so much money without yielding results. Nevertheless there are numbers of genuinely good opportunities in the district for legitimate mining work, and if this is carried on in a well directed and economical manner, having regard only to getting returns out of the ground and not out of the share-market, I have little doubt that in course of time there will be steady and productive mines opened up. It cannot be gainsaid that this field stands very ill in the public estimation at present, but it has been condemned without a fair trial, mainly on account of useless and extravagant expenditure on everything except the lodes themselves.

Alluvial Tin Deposits.—Throughout the Ben Lomond District there has been but little alluvial tin obtained. Such gravel drifts as have been found are of comparatively small extent and shallow, and are confined to the valleys of the existing watercourses. Those of Gipps' Creek have been the most important As this absence of alluvial tin is often regarded as an indication of poverty of the lodes beneath, it is of consequence to point out that there are reasons for it, both geological and topographical. On the terrace where gravels are often expected to be found the patches of the coal-measure formation abundantly seen widely spread all over it show that till quite recently the granite, the matrix of the tin, was covered by younger non-stanniferous deposits, and has not been subjected to any appreciable amount of aqueous erosion, which alone could set free and concentrate its contained tin ore. The only places where there has been any considerable erosion of the granite are in the deep gullies of the creeks running down from the terrace. Even in these, in the Castle Carey and Gipps' Creeks more particularly, there is proof that great portions of the valleys have been scooped out of the permo-carboniferous strata before reaching the granite, so that the amount of this that has been sluiced by the operations of nature is smaller than might be at first thought. But the principal reason of these creeks not carrying more tin is the steepness of their beds, on account of which the ore has no doubt been swept down into the South Esk Valley, and should be looked for in the deep flat ground where the streams debouch into it. A certain small amount of tin is found in all the creeks, and in Gipps' Creek, where, through the bed being in places flatter than is usual, accumulations of gravel have been deposited at more than one part of the valley, the workings have assumed considerable importance.

Clunes Workings.—To the west of the Long Tunnel Company's ground, on Sections 2267-87M. and 2265-87M., a considerable amount of alluvial tin has been obtained from a branch creek running into Gipps' Creek. The ground is not deep, rarely more than 4 and 5 feet, and though understood to have been highly payable at first is now believed to be practically worked out. The richness of this gravel argues well for the value of the lodes known to exist along the eastern slope of the valley.

Rigney's Freehold.—About a mile and a half below the Clunes workings we come upon an alluvial flat of considerable extent, being about 35 chains in length along the creek and averaging perhaps six chains in width, an area of from 15 to 20 acres. The creek on which the Great Republic Company's battery is situated joins Gipps' Creek towards the head of this flat. A piece of land comprising this flat, and in all containing 107¼ acres, has been leased from the owner, Mr. J. F. Rigney, by J. Powell and others, and is known as the Rigney's Freehold No. 1 Company's Block. About 30 chains lower down, and at and below the junction of the small creek that runs past the Ben Lomond Tin Mining Company's battery with Gipps' Creek, there is another smaller flat comprising about 10 acres in all, which is contained in a block of 124 acres leased by Mr. Rigney to Hudson and Murrell, and known as Rigney's Freehold No. 2. Still further down Gipps' Creek other similar flats are seen which will doubtless be worked if the above-mentioned two claims prove payable. The geological features of the valley are noteworthy and supply an explanation of the formation of the alluvial deposits. The eastern side is composed of steep slopes and cliffs of, in the upper part of Block No. 1, granite, and, in the lower part of No. 1 and the whole of No. 2, coal measures, sandstones, shales, and limestones. The western side appears at first sight to be all greenstone, but here and there we find traces of carboniferous shales showing under this rock, and in reality it would seem that the coating of greenstone on the slopes is only a superficial one. Further examination shows that the greenstone is all in loose blocks, and frequently the shape of the ground reveals that numerous landslips have taken place. The high ridge west of the creek seems to be composed of green-

stone, and may be either a dyke or a flow which has run over the carboniferous rocks, and has no doubt supplied the blocks that now cover all the western slopes of the valley.

At a point in No. 1 Block west of the head of the alluvial flat, and at an elevation of 220 feet above it, alluvial gravel consisting of waterworn quartz, granite, and granitic lodes-stuff, and containing some fair prospects of tin ore, has been discovered on the slope of the hill. This appears to form a terrace some three or four chains in length, but had not been cut into at the time of my visit (27th May, 1892) sufficiently to show its width. The finding of river gravel at such an elevation above the present stream is very instructive, and opens up a large field for prospecting, for there may be many other such terraces along the slopes of the valley on both sides. The gravel must have been laid down when the stream ran at a much higher level and had not eroded its valley to anything like the present depth. As time went on it has cut its way lower and lower, and there is therefore a probability of finding other terraces left behind on the slopes of the valley at various elevations. At the lower end of the flat on No. 1 Block, on the western side of the valley and 40 feet above the flat, alluvial gravel left in this way has already been found. It contains some tin ore also. These two older deposits on the slopes of the valley are not likely to be the only terrace drifts left behind by the creek while cutting its way downward, and it will therefore be advisable to prospect both sides of the valley for others. The presence of tin ore in both terraces in appreciable quantities is also a strong argument for the existence of rich gravels in the present river flats, as much of the gravel of the older terraces must naturally from time to time have been washed down into the creek. In prospecting for terrace gravels regard must be given to the possibility of their being covered by superficial slips of greenstone from the higher parts of the ridge. So much of this appears to have gone on that there is a strong probability that most of the gravel deposits will be covered. The readiness with which the surface soil of these slopes slips is easily explainable when we consider that the valley has been in great measure eroded out of a mass of soft shales which readily become clayey on exposure to atmospheric influences. Rain-water descending through the porous surface stuff is stopped by the shales below and runs along their clayey surface, thus causing slips of the overlying material. The rather common occurrence of springs of water on the western slopes of the valley is due also to the drainage waters being unable to sink into the shales, but finding a passage between them and the surface stuff.

The formation of flats of alluvial gravel in the creek is now easily explained: from time to time large landslips have slid down into the valley and blocked the stream. In the dams so formed gravels have accumulated until the barrier has been cut through again by the running water. In the case of the two properties mentioned, it is probable that the present outlets from the flats are not yet so low as the original creek bed, as the gravel deposits appear to be deeper than them. The stream has been forced over to the eastern side of its valley by the slips and has cut down there to solid rock, which has then prevented it from scouring down to the old level. In both flats it has been found necessary to blast tail-races through the solid rock bars at the outlets in order to be able to work the drift behind them. In the No. 2 Company's tail-race the bar is fossiliferous limestone and calcareous shale belonging to the permo-carboniferous system, and very rich in organic remains. The bar at the outlet of the No. 1 Company's flat is a dark shale, divided by strong joints into polygonal prismatic blocks resembling basaltic columns when seen at a little distance. This polygonal vertical jointing is probably due to the presence in the near vicinity of a greenstone dyke, which has strongly heated the shales. The joints are clean-cut plane faces, and the blocks show sharp angles between adjacent faces.

In both flats a number of test pits have been sunk to prove the ground, with very encouraging results. This work was still in progress when I visited the claims. The holes are from 8 to 16 or 20 feet deep. One which was free from water when I saw it was 12 feet deep. There were 6 feet of black surface soil on the top; then 6 feet of heavy gravel, composed mostly of granitic debris, and containing more or less tin all through it; then limestone bottom, which had a slight pitch westerly away from the present stream. Mr. Macdonald, who was in charge of the work, informed me that this feature was very noticeable in most of the pits he sunk, indicating that the old original creek-bed lay to the westward, under the covering of slipped greenstone blocks which has driven the stream out of its old channel. As might be expected, considerable difficulty is experienced in sinking these pits on account of water, but enough has been done to show that there are large quantities of tin-bearing gravel, and that the deepest ground lies along the foot of the western slope of the valley, or even under it. I do not think, however, that as a rule there will be any large extent of gravel found buried under the slips, though the main gutter must in places be so covered. Between the two flats the gully in which the creek runs is narrow and with steep sides, but one or two holes have been sunk, and proved that there is gravel to a considerable depth below the bed of the stream, and that it carries tin. Wash is to be seen in one place in the side, covered with surface detritus. On the whole I am quite satisfied that this creek amply warrants a working trial, and that present appearances are all in favour of its being payable when worked by hydraulic sluicing. The wash might be treated by ground-sluicing without much trouble after deep tail-races had been blasted through the rocky bars at the outlets, but the advantages of the hydraulic method in cheapness and expedition are so great that there can be no question that it is the proper one to adopt. It might be advisable, in order to thoroughly test the ground before going to the expense of bringing high-pressure water on to it, to do a certain amount of ground-sluicing, but when the real work begins, hydraulicking must be resorted to. As an example of the cheapness of hydraulic work, I may quote the cost of it at the Blue Spur Company's claim in Otago as given in the Reports on the Mining Industries of New Zealand, 1891. Here the material is not only broken down and sluiced by the hydraulic method, but also elevated to an average height of 60 feet by means of hydraulic elevators. During the year ending 31st December, 1890, 410,000 cubic yards of stuff were elevated and sluiced, yielding only 1¾ grains of gold, or a value of 3½*d.* a yard. The expenditure on wages was only about 1⅓*d.* per yard. It will therefore be evident that under favourable circumstances tin drifts yielding only from a quarter to half a pound of tin ore to the cubic yard could be profitably dealt with by hydraulic sluicing.

The facilities for hydraulic work in the present case are unusually good. The outlet of the upper flat is about 300 feet below the Clunes workings and 750 feet below the Great Republic mine; the second flat is about 60 feet lower. Gipps' Creek affords a never-failing supply of water, and smaller supplies, but of greater head, can be obtained from the Great Republic and Ben Lomond Creeks. Only comparatively short pipe-lines would be required. Water can also be got during the winter from the top of the ridge on the western side of Gipps' Creek, and this supply will enable the terraces to be worked. Experience in hydraulic working has shown that money is well spent when used to secure possession of copious supplies of high-pressure water, and that it is false economy to be niggardly in the matter of races and pipes. Having a good high-pressure supply will also remove any difficulty that may be encountered in getting fall for tailings as the workings are advanced into the flats, and also will do away with the need for cutting deep tail-races at their outlets, for it may be utilised to raise the stuff by hydraulic elevators. In order that the debris from the upper workings shall not be deposited on the flats lower down the stream to the detriment of their working, it will be best to avoid sending the tailings down the creek as much as possible, and the employment of elevators to stack the tailings on the worked-out ground would on that account alone be highly beneficial. There can be no doubt that if these upper flats are payable several others lower down the creek will also be worth working, and the prevention of the tailings from going down on to them from the top workings is therefore a matter of great moment. Deposition of sludge is often a source of much litigation in creek workings of this sort, and everything possible should be done to avoid it. (Some notes on hydraulic elevators were attached to my Report of last year on the Gladstone District, published with the Report of the Secretary of Mines for 1890-91).

I have not examined Gipps' Creek below its junction with the Buffalo Creek, but if there is payable tin in the upper parts there is a likelihood of there being a good deal also in favourable situations right down its course. The workings of the two companies that have been formed will therefore be of much general interest, as they will very probably be the means of opening up a considerable sluicing industry.

I have, &c.

A. MONTGOMERY, M.A., *Geological Surveyor.*

The Secretary of Mines, Hobart.

REPORT ON THE MATHINNA GOLD-FIELD.

Geological Surveyor's Office, Launceston, 12*th September,* 1892.

Sir,

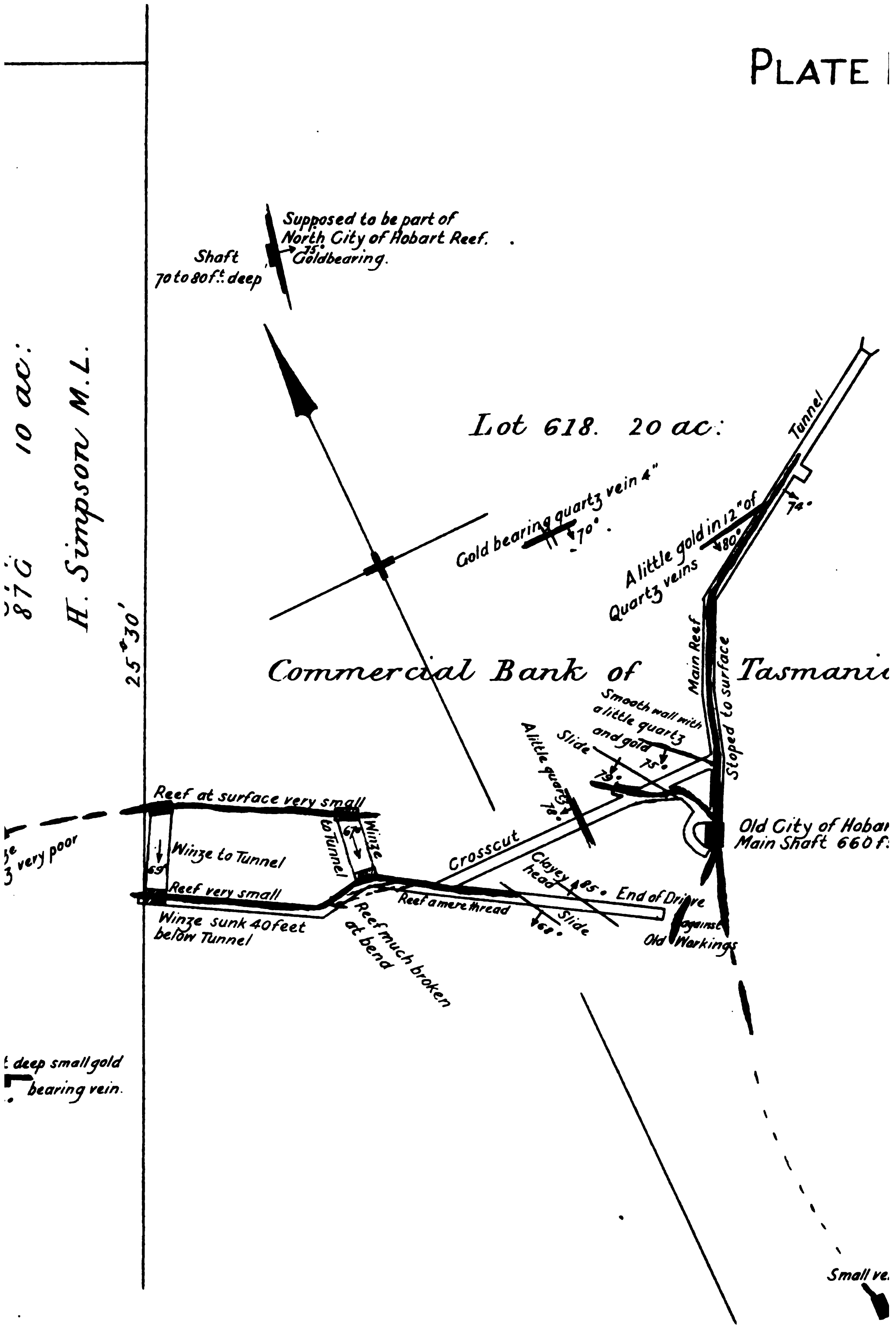
I have the honor to forward to you my Report on the Mathinna Gold-field. A month in all was spent in my examination of the district, from 30th May to 11th June, 1892, and again from 4th July to 15th July, inclusive. Owing to it being necessary to do a great deal of actual survey work in the mines and on surface in order to locate the various reefs correctly on the map and render intelligible their relations to each other, I was not able to extend my observations to the outlying parts of the district, and the present Report, therefore, deals only with the mines in the immediate vicinity of the Township of Mathinna.

This gold-field is situated about half-way between Tower Hill and Mount Blackboy, and distant 17 miles by road from Fingal Railway Station. The road from Fingal to it runs alongside the South Esk River all the way, skirting wide alluvial flats formed by the stream. Opposite the Township of Mathinna, at the bridge crossing the South Esk, the elevation above sea-level is between 900 and 1000 feet according to aneroid barometer. The principal mines are on three spurs running down to the Esk from the foot-hills of Tower Hill, and separated by two valleys known as Black Horse Gully and the Long Gully. The township lies in the former gully. In the lower portions of these valleys, where they debouch upon the alluvial plains formed by the South Esk, there are considerable accumulations of alluvial gravels, some of which have been payably auriferous.

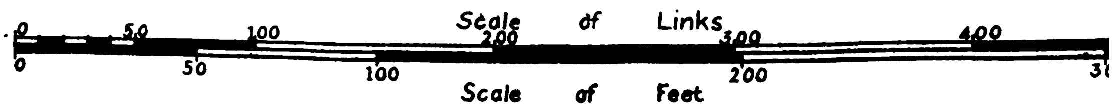
All the hills in this district are formed of slates, schists, and sandstones of Lower Palæozoic age, part of the extensive formation which is found all the way east from the Ben Lomond range to the mouth of the Scamander River, and which extends northward to past Mount Victoria. It is almost certainly the same formation that is found again at the Lefroy, Denison, Mount Horror, Gladstone, and Mount Victoria gold-fields, and has therefore proved auriferous over a large area. Fossils being almost if not entirely unknown in it, the geological age is uncertain, though probably not younger than the Lower Silurian. The general geological features of the country lying eastward of Ben Lomond are well seen in Mr. Chas. Gould's Map of the Fingal Gold-field and Mount Nicholas Coal-fields (House of Assembly Journals, 1869, No. 20), which shows plainly that the rocks of the auriferous series have been formerly covered by those of the coal measures, remains of which are now found in rings round all the high mountains; Ben Lomond, Mounts Victoria and Albert, Mount Young, Mount Blackboy, Tower Hill, Mount Nicholas, and the north slope of the Fingal Tier all showing the same fringes of Upper Palæozoic strata. It follows from this that the present surface of the older formation is in the neighbourhood of Mathinna, probably never more than 900 or 1000 feet at the most lower than that which existed before the coal measures were laid down, and consequently the upper parts of it have been subjected from time immemorial to the various atmospheric and other influences which produce disturbance and chemical alteration in the superficial layers of the earth's crust. This may have much to do with the unsettled character of the reefs at higher levels in the Mathinna field, and the large quantities of veins and bunches of quartz in the surface strata.

The strike of the beds of country has not been determined very satisfactorily, though I took its bearing wherever a good observation could be obtained. The slates and schists show a foliation or slaty cleavage running across the strike at an acute angle, which is often impossible to distinguish from true bedding, especially on the weathered outcrops of the rock. In the adits of the North Eldorado, Telegraph, and East Golden Gate mines, however, the true bedding planes can be clearly followed, and are found to run about

PLATE I



Plan of Workings
of the
MATHINNA MINE



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north west and south east, and to dip north-easterly at angles from 25° to vertical. These three tunnels, being at considerable distances from each other and giving concordant results, we may consider the above to be the normal strike of the country beds. The foliation planes run about N.N.W. and S.S.E. and dip pretty vertically. Several sets of joints cross the beds, but I was not able to find any degree of regularity in their direction: in the New Eldorado mine the main joints have a strike about N. 60° E., but elsewhere they varied very much. These points are noticed because a connection is sometimes traceable between shoots of gold in reefs and the beds and joints of the country enclosing them. The flat dip of some of the strata should accordingly be borne in mind: in the East Golden Gate adit it is only 28°, and in the North Eldorado adit from 25° to 60°. They are doubtless bent into a succession of synclinal and anticlinal folds, and it will be worth noting, as sections are exposed in the mines, whether these recur at short intervals, showing the beds to lie on the whole fairly horizontally, or whether there is a general dip of the whole mass of strata to the north east or south west. This will be of importance in enabling the position of belts of hard country and of strata favourable and unfavourable for gold, should such be found to exist, to be foretold as likely to be encountered in the mines. Present appearances incline me to think that on the whole the strata have a dip to the north east.

It may be here noted that the occurrence of cleavage planes more or less directly across the planes of sedimentation of slaty rocks is essential for the production of good roofing-slate; and as this character is seen to obtain in the Mathinna district, there are grounds for hoping that some of the harder belts of the country rock may be found to yield this valuable product. This possibility is commended to the attention of prospectors.

Though this gold-field was one of the first worked in the Colony, surprisingly little mining worthy of the name has been done in it till quite lately. The old City of Hobart mine, it is true, went down to a depth of 660 feet, but, with this exception, almost nothing had been done at greater depths than 100 feet, and very little even below 50 feet, until the recent success of the New Golden Gate mine led to a revival of speculation and the sinking of several deeper shafts. Numbers of bunches and veins of good stone have been found and worked downwards from surface as long as they were payable in the earlier days of the field, but no systematic work was done, and as soon as the stone became poor, or broken up, or faulted, the mines were promptly abandoned, and the district has in consequence got the name of being "patchy" and unreliable. Later developments have shown that a principal cause of the uncertainty of the veins at surface is, in all probability, the disturbed nature of the superficial country rock, it being necessary to sink some distance before really solid and settled country is reached. A possible explanation of the unusual amount of superficial disturbance has already been suggested. The following description of the various mines will enable me to show what has been done in each case, and allow conclusions to be drawn as to whether this field has been fairly tried and found wanting, as its detractors aver, or if it is a very promising and practically untouched one, as is my own opinion.

Mathinna Mine.—Under this name are now included the old City of Hobart, North City of Hobart, and Champion mines, situated in 20-acre Section, No. 618. The relative position of these is seen on the General Plan, Plate No. 1, sent herewith, and the principal workings on a larger scale in Plate No. 2. The old City of Hobart lower workings are now not accessible, the ground having fallen in. The following particulars have, however, been very obligingly supplied to me by Mr. Peter Irvine, who was manager of the mine in its last days. He writes:—"My remarks will be from memory, but will be approximately correct. In 1877 I took charge of the mine, and was in charge until it was abandoned in 1881-2. When I took charge a shaft 9′ × 3′ was sunk to a depth of 460 feet from surface. The reef is what is called a 'North-and South reef'; the true course is about 15 degrees east of north, with an underlay of 1½ in 6 to the west, and with a slight strike or pitch to the north. The quartz from the surface down to about 300 feet was of a white, rather loose nature, averaging about 3 feet wide and very good, being considerably over an ounce to the ton; stone being easily got, the walls or country being a nice soft slate. The quartz below that down to 660 feet, the depth to which I sunk it, was of a beautiful laminated character, the seams greatly charged with arsenical pyrites carrying a good percentage of fine gold; the stone in size about 16 inches; the country here a hard blue slate. At 580 feet deep a slide was met with which threw the reef over 8 feet to the west and also carried the shoot of gold away to the north at an angle of 45 degrees, and I may say that shoot of gold is still there. I tried to induce the company to drive for it, and also the men to tribute for it, but it is left there for a future generation to take out. Now I come to what I believe to be the cause of the stoppage of the works at that mine. There were several reasons: the principal one was the short shoot of stone, only 50 feet in length, and too small to take out without breaking into the hard walls; also want of prospecting, that is, crosscutting and driving on the line of reef, which had splendid walls as far as it was driven on; also the hard country to sink. The last contract for sinking was £9 per foot, good men, and they did not do very well out of it. We sunk for 60-feet levels, so you will see that it took more gold than came out of the one 60-feet stopes to sink for another 60 feet and so on, and we had nothing to spare to do any other dead-work. We had a very nice winding and pumping engine on that shaft with a 7-inch plunger and draw-lift, but not a great deal of water to contend with; but the machinery was too light for the depth—the one engine had to do both winding and pumping." Mr Irvine concludes his letter by saying, "But I have not the slightest doubt that the mine is a good one, and the time will come that, with proper machinery and systematic working, it will prove to be one of the regular dividend-paying mines of the Colony." I may remark that Mr. Irvine's account of this mine agrees entirely with what was told to me by other old residents of Mathinna familiar with the workings. The "eyes were picked out" of the reef, as miners say, and no driving was done on the course of it to find other bunches and shoots of good stone. Where the quartz became too narrow to work profitably it was left standing, and sinking was resorted to until the increasing cost of working and need for more powerful machinery made the mine unremunerative. The machinery was forthwith sold off, the battery dismantled, and the mine allowed to fall in.

It is to be noticed that in the lower workings described by Mr. Irvine the underlay was to the westward: in the adit shown on my plan it is to the eastward. I have not been able to ascertain exactly the depth at which the turn took place, but all accounts agree that there was a change of underlay. The shaft, 200 feet deep, seen on the plan just east of the entrance to the adit was sunk to cut the reef, but failed to do so on account of the change. The main shaft is said to be sunk in solid slate of the footwall country for about 400 feet in the bottom, which, if correct, would show that the turn took place somewhere about the 200-feet level.

The workings now accessible consist of the adit and drives from it shown on the plan. Two attempts have been made to get round the broken ground at the shaft in order to drive southward on the line of reef, but in both cases the old workings were encountered, and the drives were not persevered with. In the western drive from the adit a small reef has been followed, and the same has been traced on surface by trenching, and followed down to the adit level in two winzes. It is gold-bearing, but very small. In the winze at the boundary of the Section it averaged from two to three inches only; and did not improve in size, but rather got smaller in a continuation of the same winze sunk 40 feet below the level of the adit. The quartz is stated by Mr. Clerke, the manager of the mine, to have yielded 13 dwts. of gold to the ton. In this winze the stone was on the hanging-wall; in the one further east it was the same also, averaging perhaps four inches in size, and yielding 12 to 13 dwts. to the ton, but in this case at the tunnel level there appears to be a good deal of quartz running into the footwall as well, and a little cross-cutting might be done with advantage. This reef has in parts very well-defined smooth walls, but in other parts is very much split up and hard to follow. In the drive on it from the cross-cut towards the old main shaft the smooth footwall is cut off short by a slide which doubtless heaves it to the southward, but no attempt has been made to recover it. There are several of these clayey heads and slides running about N.W. and S.E. in the angle between the two reefs, but none of them appear to be faults of any magnitude. Some of them have a little quartz in them, and one at the east end of the cross-cut carries a little gold. It is possible that they may have some connection with what is known as the North City of Hobart lode, which is due to join the City lode somewhere about this place, though possibly the latter lode is itself identical with the former, in which case the vein of stone followed in from near the mouth of the adit would only be a branch. The North City lode is supposed, however, to have been struck in the old shaft, seen in the top left-hand corner of the plan (Plate 2). About 10 inches in thickness of quartz is here visible, and a good deal of stone is said to have been taken out and crushed, but I have no information as to the yield of gold. It thus seems probable that there are either two or three lines of lode joining or intersecting one another near the old City of Hobart shaft; but there appear to be so many small auriferous veins in the surrounding country that definite conclusions as to lines of lode cannot yet be come to.

The main lode is supposed to have been picked up again to the south of the main shaft, in a prospecting shaft about 40 feet deep, shown on the plan. The reef in this is small, about six inches wide, but carries some gold. Further south, on the adjoining Section 885-87o, held by M'Murray and Davidson, a shaft, known as the City of Hobart Extended shaft, has lately (in 1891) been sunk in search of this lode to a depth of some 130 feet. It is only six feet by 3 feet in size—an example of false economy, as such a small shaft can never be used for working purposes. The workings were shut down when I saw them, and much water was in the shaft, so that I could not go below, but gold-bearing stone is reported to have been obtained.

In the south-east corner of Section 618 there are some old workings formerly known as the Champion mine. The reef in these has two branches running between N.W. and W.N.W. A considerable amount of stoping has been done, but the workings are now inaccessible. The quartz is stated to have returned about 7 dwts. to the ton. This lode also should run into or through the main lode.

The workings on the old North City of Hobart lode are in the north-western portion of the same section. For about 130 feet along the boundary a surface trench or underhand stope on the reef still remains open, the channel being from 18 to 30 inches wide, which is said to have been the width of the quartz. The lode dips eastward 75°. A little further to the north-east, in flat ground, are several old pits and trenches in which quartz was obtained. Two shafts were sunk about here, both now fallen in, one 60 feet or thereabouts, from which gold-bearing quartz carrying 6 dwts. to the ton was taken, and the other over 100 feet deep, which was being sunk as a whim-shaft, but never reached the reef. The quartz from the whole of this lode is said to have been of low value, only about 2 dwts. of gold to the ton as a rule.

It will be seen from the above that gold-bearing stone has been obtained throughout the whole length of Section 618, and that there are probably three or four distinct lines of lode in it. The veins as a rule have been small, and difficulty has been experienced in tracing them owing to the quartz running very thin and breaking up into strings. All the lines of lode appear to be converging to a point a little south of the old City of Hobart shaft. The prospects of mining are not very bright, but still in my opinion warrant a trial. It would not, I am afraid, be possible to re-open the old City of Hobart shaft without as much expense as would sink a new one of larger and more convenient size. Further prospecting would be best done from a shaft, and at such a depth as to be in solid settled country. In the old workings the friable white quartz was replaced by laminated stone carrying pyrites at about 300 feet, which indicates this depth as a proper one for opening out at. Exploratory work should then be done by cross-cutting and driving upon the various lines of lodes.

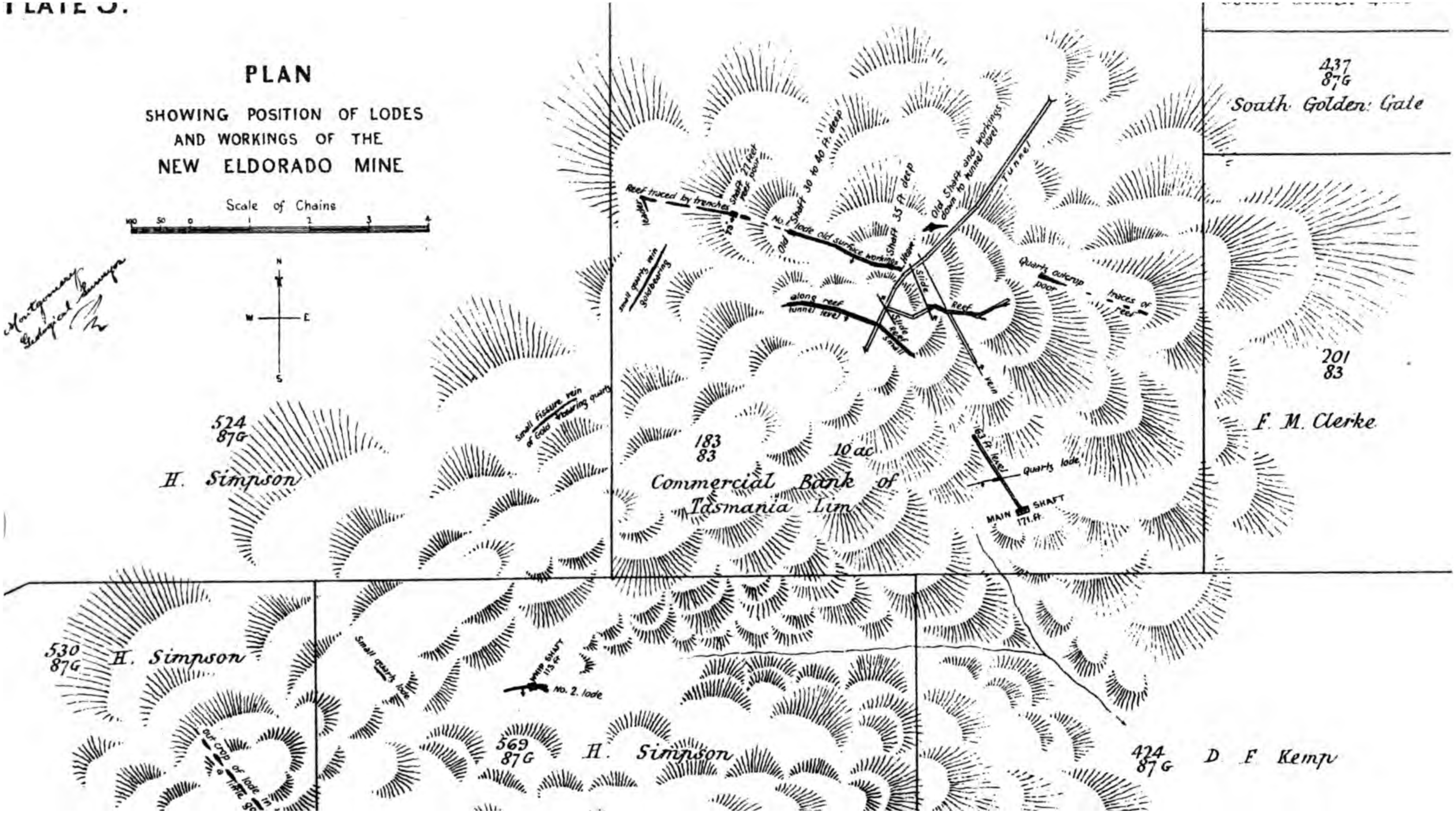
The Mathinna Company possess a fairly good 10-head battery of the usual type, which would be much improved by the addition of a pan to grind blanket sand, and some concentrating appliances such as Frue vanners, for saving pyrites. There is a large quantity of old tailings on the flat ground near this battery which would probably be worth grinding over again.

New Eldorado Mine.—The lodes and workings of this mine are shown on plan, Plate No. 3. The main workings are in 10-acre Section 183-83; they consist of an adit and drives therefrom, some small shafts and trenches on surface, and a new main shaft 3 ft. 8 ins. by 9 ft. 8 ins., 171 in depth. From the latter a cross-cut is being driven at the 163-feet level towards the reef, which was in 100 feet when I visited the mine and has since been extended. This will cut the lode 220 feet below its outcrop, and a little over 100 feet below the adit. The country driven through in it is a hardish slate, the rate of progress of driving

PLATE 5.

PLAN

SHOWING POSITION OF LODES
AND WORKINGS OF THE
NEW ELDORADO MINE



being about 12 feet a week with three shifts. At 58 feet from the shaft a vein of lode slate and quartz about four feet wide was passed through, running N. 80° E. and dipping southerly 47½°. On its footwall there is a good deal of quartz, much stained with brown oxide of iron, and yielding a little gold. It has been called No. 3 lode ; since my visit I am informed that it has been driven on both east and west, and that two walls crossing it have been encountered, the distance between them being some 25 feet; the western one runs N. 20° W., carries quartz, and is again met with in the cross-cut at 51 feet past the No. 3 lode ; the eastern one runs N. 30° W., and shows three feet of lode-matter. These very probably are two of the cross-courses shown on the plan which cut through the main lode at the adit level, but as they were found since my visit I have not seen them.

The workings on surface on the main reef are seen on the plan. The lode varies from two feet in width down to six inches. In its western part in the trenches where it has been exposed it is from 18 inches to two feet wide, but is poor in gold; coming eastward from these we find a shaft about 27 feet deep sunk on the reef, and showing it to be still poor, but between this shaft and the next one east of it the reef, though narrowed to six inches, is fairly rich, and from here onwards it has been stoped out to depths of from eight to 60 feet. A slide is next met with which heaves the stone to the north, but the faulted portion has been recovered and worked down to the tunnel level with very good results. Some of the quartz from the surface workings on the west side of the slide is stated to have yielded 3 oz. 18 dwts. of gold to the ton, and a crushing of 200 tons gave from 18 dwts. to an ounce. Going still further eastward the reef has not been certainly traced, it being doubtful whether some barren outcrops of quartz on about the same line belong to it or not.

The adit driven to intersect the reef at a lower level was unfortunate enough to strike it where broken by two or more slides, which seem to have puzzled and disheartened the operators. At 228½ feet from the entrance a cross-course was passed through, consisting of a vein 2 inches wide of white pulverulent quartz between well-defined plane walls, striking N. 30° W. and dipping N.E. 49°. This vein is seen again in the eastern drive on the course of the reef, and has been driven on for 62 feet. In this drive its course is much the same as before, but its dip is steeper, being 66° to the N.E., and the quartz in it, though generally soft and pulverulent, is in places hard and glassy. This vein does not appear to fault the lode at all, appearing rather to be slightly heaved itself by the latter. At 245 feet from the mouth of the adit a slide, which we shall call No. 1 slide, parallel to this cross-course is met with, which does fault the lode. This slide strikes N. 30° W. and dips N.E. 50° where cut in the adit, and N. 37° W., dip N.E. 65°, where it passes through the lode in the eastern drive. It generally shows two plain smooth walls separated by ½ to 2 inches of clay. At 299 feet another slide, No. 2, nearly parallel to the last, is met with, striking N. 32°. W., and dipping N.E. from 59½° to 65°. There are from 18 to 20 inches of clayey broken slate in this, where it goes into the east side of the adit, and from 6 to 10 inches on the west side. The tunnel has struck exactly the intersection of this slide and what has been supposed to be the main lode channel, along which a drive has been made to the eastward. At 313½ feet from the entrance the adit struck the reef, which was then driven on 102 feet to the westward and 48 feet eastward. In the western drive both hanging and foot walls of the lode are generally distinctly defined and smooth, and the channel between them is from 4 to 6 feet wide. Most of the filling is broken and slipped masses of the country rock, full of strings of quartz, but there is also a distinct quartz vein from 18 inches to 3½ feet thick in the wider portions, and dwindling down at times to only 2 or 3 inches. A rise has been put up 18 feet on the footwall, but no stoping has been done, the stone having been too poor to take out. The dip of the walls is from 56° to 64° southerly. In the drive east from the tunnel on this part of the lode the quartz vein is a mere string, increasing, however, to 6 inches in width in the face. The hanging-wall is smooth and well defined, and dips 56° to the southward. A few feet in from the adit a mass of veins of quartz, mixed through with broken country rock, is seen running off to the north-east through the footwall, which may be part of a north-easterly lode. This drive is not yet far enough to the eastward to be intersected by No. 2 slide, which, however, must be close at hand. The drive eastward from the intersection of No. 2 slide by the adit follows a smooth footwall running N. 58° to 60° W., and dipping to the southward 62°, but no quartz was got for the first 30 feet, when the wall made a sudden bend to the north-east, and broken quartz mixed with country rock made its appearance. This, however, appears to cross the drive on a course about S. 35° W., and is probably, therefore, the north-easterly lode seen in the inner eastern drive above described. The quartz is of the same broken character. On the bend in the wall there is from 8 to 18 inches of quartz, but no gold. About 49 feet from the side of the adit the No. 1 slide was struck, and a change in the reef-stuff was at once apparent. The broken quartz of the north-easterly lode is at once cut short off, and gold-bearing stone takes its place. This was followed up, and found to connect with the old surface workings. In the stopes from the tunnel upwards the slide may be clearly traced, forming their western end, and cutting off the quartz. A length of about 50 feet has been stoped on the reef above the level. At 95 feet from the adit a winze has been sunk on the lode to a depth of about 60 feet, but at 38 feet the slide was met with, and of course cut off the stone. This was of very good quality right down to the slide. Another winze has since been sunk 31 feet nearer the adit. Ten feet below the level the slide was struck, and the winze was then continued down in good stone on the intersection of the lode and slide until the first winze was broken into. There is now about 18 inches thick of quartz showing in the side of this later winze in the first 10 feet below the level, but lower down it is very thin, though a good body of stone was found all along the intersection. East of the main winze some 12 inches or so of quartz is seen going off into the hanging-wall. The drive, however, was turned more to the north-east, and soon passed through the lode altogether, the stone leaving it on the southern side 30 feet past the winze. It seems to me, therefore, that the stone going into the hanging-wall just past the winze should have been followed. A block of good quartz has been left unstoped above the winze to protect it, but this appears to be the eastern end of the shoot of gold, for no stoping has been done further in.

Not having been able to examine the old surface workings, I cannot say positively if slides Nos. 1 and 2 reappear in them. According to the ends of the workings seen on surface it would appear as if there was yet another slide running north-easterly, but I have seen no sign of such at the adit level, and it is possible that the old workings at the break extended further west underground than is seen on surface, in which case No. 1 slide would quite account for the heave. No. 2 slide does not appear to have dislocated the surface workings, and I do not think it will prove to be a fault of any importance. The smooth wall followed from the adit between this and No. 1 slide seems to me probably not to be the lode channel at all, but a parallel wall on its footwall side. It might carry quartz if followed in strike and depth.

Looking at the gold-bearing stone it is seen that the shoot is pitching eastward. The poor stone met with on surface in the western part of the lode corresponds with that portion got at the adit level past No. 2 slide. The rich stone has been cut through by the slide and heaved to the north, but in the adit is still to the east of its position on surface. The eastern pitch is also seen at the east end of the stopes from surface down to the adit. This being the case, it appears to me that the drive now being put in from the main shaft is running towards the poor ground, and that it would have been better to have driven a more northerly course to try to intercept the known shoot of gold. There would also have been a better chance of striking the lode away from the slides, but at present the cross-cut is going fair for the disturbed region.

Before stopping all work at the adit level I think it would be well to extend the drive further east along the lode channel in the workings south of No. 2 slide. This would very soon be met with, and it would be seen if it heaved the reef any distance, which I do not think it will, a piece of information valuable when searching for the lode at lower levels. This alone, however, would not be worth extending the level for, but there is a considerable chance that between it and No. 1 slide gold-bearing stone might be met with. The shoot is much longer at surface than at the tunnel level, and has been cut through by the slide subsequent to its formation. There may be a portion of the shoot still on the western side of the fault which would be worth looking for. The eastern being the most probable down-throw side of the fault, the corresponding cut-off portion of a patch of good stone found on its western side is, however, to be expected at a lower level on the eastern, and *vice versâ*.

In Section 569-87G, also belonging to the New Eldorado Company, some work has been done on another lode, known as No. 2 lode. A prospecting shaft has been sunk on the underlay 113 feet, and short drives have been put in at 19 feet, 30 feet, and 83 feet from surface. No work was being done at the time of my visit, and the bottom of the shaft was full of water. Mr. Clerke, the Manager of the mine, informed me that the quartz was a good deal broken up in the bottom, that there was a well defined foot-wall, but the hanging-wall was not seen, and that a good deal of gold was visible in the stone, which he estimated to be worth 14 or 15 dwts. to the ton. The 83-feet level (or 90 feet measured on the underlay) was, however, free of water, and was examined by me. A drive from the side of the shaft has been made 19 feet in direction S. 67° E., the last 10 feet along a well-defined footwall. This comes into the drive with a somewhat sudden bend, emerging from the country north of the shaft on a course S. 42° E. In the face there is about 12 inches of quartz carrying good gold, and a stope has been taken up above the level for 25 or 30 feet. The dip of the footwall in the stope is 75° to the southward and in the level 81°, so that the reef appears to here turn a little steeper. Below the level the dip continues about 81°. Round the shaft itself there is quite a large number of small veins of quartz running across the lode-channel towards the footwall and carrying gold, but so much mixed with country rock as hardly to be worth taking out. Very little has been done at the 30-feet level. At the 19-feet level a drive runs N. 85° E. for 8 feet and S. 80° W. for 27 feet from the shaft. The stone varies from eight to eighteen inches in width, and at this level carried very payable quantities of gold; much country rock would, however, require to be taken out and crushed along with the quartz. In sinking the shaft the hanging-wall of the lode was followed in the upper part, but it is badly defined and not always easy to trace. At the 90-feet level the footwall came in as already mentioned; in the upper levels it is not seen, the lode-channel being therefore of a considerable width between the walls. In all 77 tons of stuff were crushed from this shaft for the very good return of 105 ounces of gold. The lode is therefore well worth further exploration.

In Section 538-87G another reef has been exposed by trenches crossing the crown of a ridge. There is a great deal of loose quartz about the surface here, and a little gold has been obtained; no mining work has yet been done. The No. 2 lode should run into this one, and the junction of the two, being a likely place for gold, should be sought for. Three other small veins shown on the plan have been discovered, all carrying a little gold. The one in Section 524-87G occupies a very distinct fissure in the schist rock, and is said to have yielded several small rich specimens; it is, however, only ½ to 2 inches in width.

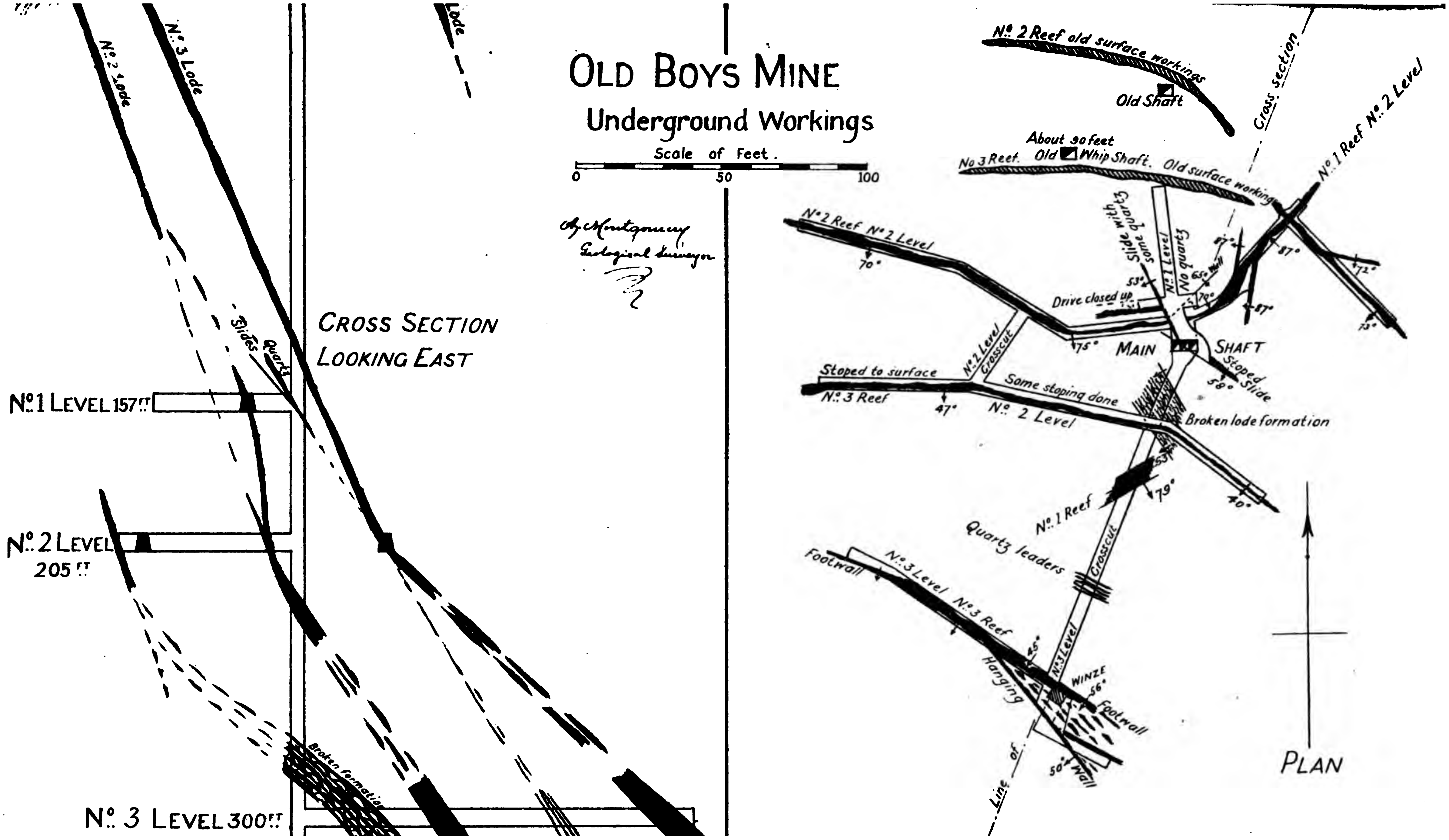
Mr. Henry Simpson, manager of the New Eldorado Company, has kindly supplied me with the following list of crushings from the mine for the last six years :—

1886	31st December	40	tons quartz gave	28	ozs. gold
1887	30th January	45	„	100	„
„	12th March	38	„	58¼	„
„	30th April	90	„	191	„
„	30th June	135	„	229	„
„	15th August	90	„	94	„
1891	14th November	30	„	64	„
1892	19th February	45	„	40½	„
„	8th August	22	„	5¼	„
	TOTAL	535	„	810	„

Mr. Clerke, mining manager, informs me that besides these crushings there were some others of older date, one of which yielded 100 ounces of gold from 29¼ tons of quartz. He estimates that quite 500 tons more have been crushed.

It will be seen that the value of the crushing-dirt has been exceedingly good, giving an average return of over an ounce and a half of gold to the ton. This should encourage the owners to go on with their main shaft and prospect the lode thoroughly. Other shoots of gold are very likely to be found, and as the reef appears to be a strong well-defined one there is every inducement to give it a fair test. The No. 2 lode is also well worth working on.

North Eldorado Mine.—Section 396-87G.—The reef worked in this section is nearly parallel to the Eldorado main reef, and is shown on the general plan, Plate 1: it has been traced on surface by trenches



OLD BOYS MINE

Underground Workings

A. Montgomery
Geological Surveyor

for over three chains. A small shaft has been sunk on the underlay to a depth, it is said, of over 110 feet, but the only recent workings are at about 60 feet. At the time of my visit a party of tributors had just finished taking out a small trial crushing of six tons of quartz, but as they had removed the top ladders and windlas-rope I did not get down into the workings. They report the stone to average about 18 inches in thickness. The reef underlays to the south about one in eight. As far as I could learn locally, the quartz from this mine has not been rich, and the workings are of very small extent. In order to cut the lode a tunnel has been driven at a level about 90 feet below the outcrop for a distance of 261 feet, but without finding it, though considerably past the point where it might have been expected to be met with. About 180 feet from the mouth of this adit a break in the country rock and a few strings of quartz may perhaps indicate the passage of the reef, being near the spot where it ought to have been cut. This break might be driven on with advantage towards the shaft to prove if it really is the lode.

Old Gladstone Mine.—Section 470-87a.—These workings are on a reef also running nearly parallel to the Eldorado reef: they have been abandoned for some time, and the shafts being full of water little is now visible. The reef appears to have been from two to three feet wide, the walls, as far as seen, showing themselves smooth and well defined. About 60 tons of quartz are said to have been crushed from here, yielding from 9 to 11 dwts. of gold to the ton. The underlay is about 18 inches in six feet to the southward. The workings seem to be of very small extent. This lode, from its position, might be identical with the one traced across the crown of the ridge on Section 530-87a of the New Eldorado ground.

Old Boys Mine.—The sections held by the Old Boys Gold Mining Company, No Liability, are 390-87a, comprising the old Black Boy mine, 394-87a, the old White Boy, and 393-87a, the old Yellow Boy. The position of the lodes is shown on Plate 1, and the more modern workings in plan and section on Plate 4. It is difficult now to get any accurate information as to the workings of the old mines, every statement concerning them having to be accepted with reservation. The Yellow Boy main shaft is a small one, about 5 feet by 3 feet, and is said to be over 100 feet deep. The stopes now open at surface appear to have had a reef from 18 inches to 3 feet wide in them, from which good quartz is stated to have been obtained : this lode runs north-easterly. The Black Boy workings were on two large reefs which crop out on the spur, towards the northern end of which the Boys shaft is situated. Several shafts have been sunk on these, and a good deal of stoping and surface trenching has been done, but the workings are not now accessible. The two reefs junction near the south boundary of 390-87a, and here a shaft was sunk to a depth of over 120 feet, the first 40 feet vertical, the remainder on the reef, which has an underlay of 1 in 2 to the westward. Mr. S. Richards, the manager of the Old Boys Mine, some time ago rigged a windlass over this shaft, and with great difficulty and risk got down into the old workings, and found that at the 120-feet level 80 feet had been driven on the lode south and 30 feet to the north. In the south end the lode had pinched; in the north it was 12 feet wide : the stone carried a little gold, but not enough to pay. In the surface trenches parts of the lode are still exposed, and the two reefs average each from two to six feet in thickness. A good deal of quartz is reported to have been crushed when the mine was at work for returns of from 4 to 10 dwts. of gold to the ton, but on the whole the reefs were not payable under then existing conditions. In Sections 435-87a and 434-87a the reef has been traced southward by several trenches and old shafts and much surface quartz, and would appear to be turning more to the south-east, but no workings of importance have been executed. The immense quantities of loose quartz on the surface testify to the strength of the reef.

It will be seen from Plate 1 that the western branch of the Black Boy reef is running directly for the new main shaft of the present company. It has not, however, been traced right through to it. The Old Boys' main shaft is the old White Boy shaft, which has been repaired and sunk deeper by the present owners. It was put down to cut two reefs which had been worked by small shafts from the surface downwards. These, now known as Nos. 2 and 3 reefs, are reported to have yielded quartz of value over an ounce to the ton from the old surface workings, some of which were 90 feet deep. They run between west and west-north-west, and underlay to the south. Another reef, parallel to these and now known as No. 4, lies under the engine-house, south of the main shaft, but the old workings have been filled up and can hardly now be seen at all. The lode known as No. 1 reef was not seen at surface ; it runs north-easterly, and appears to junction with No. 2. Three levels have been opened out from the main shaft, at 157, 205, and 300 feet. At No. 1 level little can now be seen, the drive west on the lode having been filled with mullock. Two clayey slides are here seen close to the shaft, as shown on Plate 4, both dipping south-west. Though they apparently cut off the reef at No. 1 level, they are not met with at No. 2, which shows them to be of no consequence as faults. A little quartz is found on each of them, and a small stope has been taken out on the east side of the shaft on one. At No. 2 level a considerable amount of driving has been done. Nos. 1 and 2 lodes appear to join one another just north of the shaft. No. 1 has been followed 58 feet to the north-east. There is but little quartz in it, and this is in veins from 3 inches and less up to as much as one foot in thickness in different parts of the lode-channel, which is mainly filled with squeezed and much contorted lode-slate. Several smooth clean walls are seen along the course of the drive, and it seems to me that the lode-channel is a fairly wide one, probably not narrower than 6 or 8 feet, and filled with fallen-in country rock through the interstices of which veins of quartz have formed, but likely to be filled with solid quartz in other portions of its extent. The several smooth walls and strings of quartz, the clayey selvages on these walls, and the constant occurrence of lode-slate wonderfully contorted by pressure, show the lode to be of the fissure-vein type, and argue well for its permanency. As we shall see later on, the New Golden Gate reefs in parts show exactly similar features. 7 feet from the end of the drive on this reef another line of lode running N.W. and S.E. is met with. This appears to pass through the No. 1 reef without dislocating it to any extent, which may, perhaps, be due to the almost vertical dip of the latter. A drive has been made to the south-east along this new reef a distance of 50 feet. It winds about a good deal, but on the whole preserves an even course. At first it contained from 6 to 18 inches in thickness of quartz, but at 19 feet 6 inches of quartz run off on a more easterly course along a smooth wall, and from this point to the end of the drive there is hardly any quartz.

In the face the lode-stuff is 2 feet 9 inches wide, with only a little quartz on the hanging and foot walls. This reef has well-defined smooth walls dipping south-westerly 73°, but, like No. 1, is mostly filled with lode-slate at this level.

Westward of the shaft the drive has been carried 140 feet along No. 2 reef. There are only strings and bunches of quartz in a channel filled with broken and squeezed lode-slate along this drive. The channel is from 8 inches to over 6 feet in width, and has smooth walls with clayey selvages. As shown on the plan, a cross-cut has been driven at this level to cut No. 3 reef, and drives east and west have been made along this. The drive west is 53 feet in length, and above it the ground has been stoped up to or nearly to the surface, the shoot of stone having apparently a pitch to the south-west. In the face the lode is much broken, but appears to be a large mass of quartz, and to be making into a strong body of stone in the south-west corner. In the drive east, which is 109 feet long, there is little more than a mere string of quartz, the channel being from 6 to 8 inches only in width, and mostly filled with crumpled lode-slate. One or two small stopes have been taken out where patches of quartz have occurred.

At No. 3 level a cross-cut has been driven in a south-south-westerly direction a distance of 134 feet. From 13 to 30 feet from the shaft a lode, consisting of broken twisted lumps of country rock with a good deal of quartz through it carrying a little gold, was passed through. The walls were not at all distinct, and the course is consequently not well ascertainable, but it appears to be N.W. and S.E. The same lode was passed through in the shaft a short distance above the plat, and from its course and dip it is therefore very probably identical with the reef in the east end of the drive on No. 1 lode at No. 2 level. Between 44 and 54 feet from the shaft No. 1 reef is met with in the cross-cut. It was also cut in the shaft from 15 to 24 feet below No. 2 level, and though lying rather irregularly had at times as much as 3 feet of gold-bearing stone, which was saved for crushing. In the bottom level a little gold can be obtained all through the lode formation, but there is only a little quartz, and that much mixed with broken country rock. Towards the footwall some bluish quartz seems identical with a band of stone passed through in the shaft in which the best gold was got. At 89 feet the cross-cut went through several small veins carrying a few "colours" of gold. These have been taken to be No. 2 reef, but I think they are more likely droppers from No. 3, as shown on the section, and that No. 2 is not seen on account of its junctioning with No. 1 as in No. 2 level above, on the west side of the cross-cut. At 122 feet the footwall of No. 3 lode is struck, dipping here much flatter than in the level above ; indeed all the reefs appear to run flatter below No. 2 level. From the cross-cut a drive has been extended west 80 feet, the footwall being followed for 33 feet, after which it veered round more to the south, and in the face is in the south-west angle of the drive. At 33 feet the hanging-wall came in on the south side, and in the face the two walls are close together, with 12 inches of lode-matter between them. The contents of the reef in this drive are load-slate, with but little quartz and very poor in gold. Seeing that the shoot of stone in No. 2 level pitched westward, however, and that this drive is not yet far enough west to be under where it might be expected, I think it would be advisable to continue driving another 50 feet in the hope of getting the same run of gold-bearing stone. It is to be noted that so far as this drive has been extended no sign has been yet seen of No. 1 reef running into it, though from its course both at No. 2 level and in the cross-cut it ought to have been met with, which leads me to think that it must turn round in the same way as in No. 2 level to join No. 2 reef. Possibly, we should not call Nos. 1 and 2 reefs separate lodes, but regard them as one and the same, though much bent. The cross-cut has been continued on to 134 feet from the shaft, and terminates against the smooth hard hanging-wall of No. 3 reef, dipping S.W. 50°. In the floor on the footwall a body of gold-bearing stone was cut, pitching west so as almost at once to disappear beneath the drive west on the reef. Had the cross-cut struck the latter four feet further west the stone would have been missed unless a drive had been put in to the eastward. Going east the stone is rising, but at the time of my visit it was not possible to estimate at what angle. A winze had been sunk on the underlay 24 feet, and a drive put in along the footwall 26 feet east from the winze, when I saw the mine. At the winze there were 18 inches of solid gold-bearing quartz, and in the face from 12 to 15 inches. The quartz contained a good many specks of arsenical pyrites and galena, which in this district, are generally associated with gold. This body of quartz was separated from the lode-slate in the reef channel on its west end by a distinct selvage and similarly from the broken lode-slate forming its hanging-wall : the true hanging-wall of the formation is seen in the chamber for the winze to lie twelve or more feet south of the footwall carrying the quartz. The lode formation seems to be getting wider at this point. It may be remarked that the occurrence of the gold-bearing quartz here in a body separated from the main lode-slate filling of the reef channel by selvages is exactly similar to the way in which several of the gold-bearing bodies of stone in the New Golden Gate mine have been found. A crushing of 67 tons of quartz from this place, including however, a few tons of stone from the No. 1 reef, were passed through in the shaft, yielded 43½ ounces of gold. Since my visit I understand that work has been continued on this stone, which has narrowed and widened again more than once, but continued to yield payable quartz. This shoot lies to the eastward of all the upper workings, and might perhaps be met with by extending them. The pitch of the ore to the westward recalls that the shoot on the same reef worked above No. 2 level was also pitching westward, and gives hope that this mine will show the feature so common in many others of several parallel shoots of ore. It is encouraging also to find good quartz in the east end of the lode, for it is in that direction to my mind that prospecting should be most vigorously carried on in the hope of reaching the intersection of these reefs and the main reef of the old Black Boy workings. This is more likely to come on the east side of the shaft than on the west, and the very frequent richness of junctions of lodes makes them always worth exploration.

This mine seems to me a very promising property. The lodes are of a considerable size, and have been proved persistent to a depth of 300 feet, and show stronger and better defined in the bottom than in the upper levels : though much filled with worthless lodeslate they have in two places shown shoots of payable stone ; they doubtless join or intersect within a short distance the strong Black Boy line, which though poor where worked was nevertheless gold-bearing and consequently in other parts of its extent may be rich, and the country rock appears to be more settled at the lower levels. To predict success to a mining venture in the present state of this one would not be justifiable, and would be the assertion of a hope or probability as a certainty, but there are undoubtedly good grounds for entertaining expectations of success and consequently for spending money freely in the vigorous development of the mine by sinking and driving,—sinking I regard as of the first importance.

In Section 394-87G, 184 feet from the south-east corner, a prospecting shaft has been sunk on a small gold-bearing lode which from its course and position may be part of the old Yellow Boy reef. The stone was followed down to 18 feet, when a slide came in dipping easterly and cut it off. The shaft was then carried down to 80 feet and cross-cutting commenced; when I visited this work a drive had been put in 11 feet on a course S. 45° E. Some quartz about 12 inches wide with a good deal of intermixed slate was cut 9 feet from the side of the shaft; course S. 77°, W., dip S.E. 71°. Should the Yellow Boy reef be found in this shaft it would be worth driving on to its junction with the Black Boy reef.

St. Patrick's Mine.—A small reef, which is very likely an offshoot from the main Black Boy line, but may be connected with the east and west reef of the Mathinna Company's holding, is found in Section 437-87G, and has been traced by trenches eastward into 465-87G. A prospecting shaft, six feet by three feet, has been sunk on the underlay to a depth of about 60 feet, and about 40 feet further east another small shaft, now fallen in, has been put down. No work had been done for some time in the mine, and the ladder way seemed very insecure, so I did not go down into the workings. Very little quartz was in the paddock, though none is said to have been taken away, and as far as I could see the vein is very small both in the shafts and the trenches.

The New Golden Gate Mine.—This mine has been the cause of a revival of mining in the district, and is by far the most important in it. It presents several very noteworthy features, and throws much light on the nature of the reefs of this locality and must therefore be described in considerable detail. The principal workings are in Section 13-87G; the shaft and surface workings are marked on Plate No. 1, and all the underground workings are shown in plan and sections in Plates Nos. 5, 6, 7, and 8. The ground has been held by three or more successive owners, the predecessors of the present company having been unfortunate enough to pass over the main auriferous bodies without finding them. Their operations were on what is now known as the western reef; this was worked down from surface at first, and then a long adit was put in to cut it about 50 feet below the surface. In the first half of this two lode-channels were passed through, now recognised to be those of what are termed the Main and Loane's reefs. At the time they were cut they were not thought anything of, as was indeed only natural, as there is very little in them to distinguish the lode-stuff from the country rock. From end to end of this adit the latter is much weathered and broken, and contains a great many veins and bunches of quartz, and the two lode-channels appear very little different from the rest of the country, being filled almost entirely with broken slate and clayey matter with but little quartz. About 210 feet in the adit passed through a mass 10 feet thick of quartz veins lying in irregular fashion in the country rock without defined walls, and 15 feet further in another lode was struck. This contains a good deal of quartz and much country rock, with strings of quartz running through it. The walls are not clearly defined, the most distinct being one which has a north-westerly course and north-easterly dip. This agrees fairly well with the position of the reef at the No. 2 cross-cut 146 feet lower. A little driving has been done on this lode as shown on the plan, almost entirely in lode-matter containing much quartz; these drives are utilised as a powder magazine. The name of the Central reef has been given to this lode. Between this and the Western reef at the adit level the country rock contains many bunches and veins of quartz, and though this feature is not seen at the lower level, I am disposed to believe that the Central and Western reefs are branches of one and the same lode, and that they will be found to unite going north and perhaps also to the south. The Western reef was reached in the adit 310 feet from the entrance, and has been driven on at this level as shown in plan. In the drives several smooth hard walls are seen, but these do not appear to be main walls in every case, there being several walls in the lode-channel, a feature also often exhibited by Loane's and the Main reefs. Some of these are marked on the plan. In the old workings the reef had a slight underlay westward, but the general dip of the walls and of the stone in a winze sunk on the footwall is to the east, and in the lower level the reef lies to the east of its position in the adit, so that on the whole it has an easterly underlay. The reef in the workings has varied very much in width, from only a few inches of quartz up to eight or nine feet. In the southern drive the lode is much broken, and a stope has been taken out underfoot to a depth of about 35 feet on a vein of stone that runs almost at right angles across the general course of the reef. The present owners have done very little in this part of this mine at the adit level, and it is difficult to get accurate information as to the old workings. Mr. James M'Murray, who was the last to work it (about 1881) on any considerable scale, states that his first crushing of 23 tons yielded 9 dwts. 12 grs. of gold per ton; his next of 124 tons gave 13 dwts. 12 grs. to the ton; and then a still larger crushing of between 200 and 300 tons only returned from 3 to 4 dwts. to the ton. Two parties had previously worked the reef and taken out more or less gold. It will be observed on the plan that both at adit and No. 2 levels the footwall runs off into the country on an almost southerly course, corresponding with that of the longest body of old workings, and it may therefore be possible that going south this reef branches, one part going south-east to join the Main and Loane's reefs, and the other keeping a southerly course. Against this may be urged that the reef must turn to the west of north going northwards or it would have been cut sooner in the western cross-cut of the North Golden Gate mine, unless perchance its underlay changed. At No. 2 level both Central and Western reefs have again been cut, as marked on plan. The Central reef is still badly defined, but a little gold has been got in it in a winze sunk about 18 feet. The Western reef, where first struck, is composed of from 3 to 4 feet of solid quartz containing a little gold, but 30 feet from the cross-cut it gets small and in the face there is only a little quartz, the lode-channel being 4 feet 6 inches wide, filled with lode-slate. As this reef has been payably gold-bearing in parts it should not be neglected altogether, but a certain amount of prospecting should be steadily carried on upon it. It will be easier to do this from the shaft at the 600 or 700 feet levels, however, than higher up, as there will not be so far to drive to reach the reef. (See cross-section, Plate No. 6.)

The discovery of gold which has given the New Golden Gate mine its present prominence was first made in the adit level, a little gold-bearing quartz having been found by A. Loane while picking into the floor of the drive where the lode-channel of the reef which now bears his name had been passed through. This led to his sinking a winze in which more gold-bearing stone was got, the quartz yielding 1 oz. 8 dwts. to the ton. About 40 feet below the adit the weathered yellowish slate country changed to blue slate, this depth being apparently the limit of superficial oxidation by the atmospheric influences, and the reef almost at once became a solid body of quartz from 2 to 4 feet in thickness; down to this level it had been rubbly and broken. The main shaft was then sunk, and about 100 feet down struck a till then unknown reef carrying gold, now know as the Main reef. Since then the development of the mine has been vigorously and skilfully prosecuted, with highly remunerative results. The shaft is now 510 feet deep, and the No. 6 or 500 feet level is being opened out, while there are large reserves of crushing stuff still in the upper levels to be stoped.

The Main reef and Loane's reef both alter their course pretty frequently, but on the whole are fairly parallel in the northern portion of the mine. South of the shaft they junction, as shown on plan, the junction getting further and further south at each successive lower level. Towards the north end the reefs must either diverge pretty widely or else Loane's reef splits into two branches, the western one of which diverges rapidly from the eastern, otherwise the Main reef could not be missed by the cross-cut from the North Golden Gate shaft, which appears, however, only to have cut Loane's reef or a western branch from it. In the fact of the workings being at the junction of the Main and Loane's reefs with one another, and also not far from that with the Central, and perhaps, Western reefs, lies the explanation of a number of the unusual features presented by this mine, and a possible key to the question, of much interest to the district, as to where to look for the extensions of the New Golden Gate lines of reef.

On the plan the portions of the reefs carrying payable gold-bearing quartz have been dotted, the parts left white being "dead ground" generally filled with broken and twisted lode-slate carrying but little quartz, and not payable to take out. There is very often a distinct selvage between the body of auriferous quartz and the "dead ground." The dotted portions on the sections, plates 7 and 8, also indicate the auriferous quartz. The size of the reefs, as might be expected, varies very much, from quite small to as much as 30 feet. At No. 4 level Loane's reef was 22 feet wide, all payable stone. On the Main reef above No. 4 level one of the stopes was 18 feet wide, the quartz being a solid white mass from side to side. Widths of from 6 to 8 feet of stone have been common in various parts of the mine, and probably to say that the quartz averages 4 feet in width throughout the ore-bodies would be a conservative estimate. Some of the quartz is remarkably white and like loaf-sugar in appearance; some laminated, the layers of quartz being separated by thin seams of greasy black polished slate; in other parts it frequently contains angular fragments of the wall-rock, and shows brecciated structure; and not uncommonly it exhibits smooth highly polished slickensides or friction surfaces. In both reefs the number of smooth planes or "walls" coated with clay, often exhibiting striæ and other evidences of motion of the walls one upon another is very noteworthy. These may often be taken for the true walls of the reef, when they are in fact a very considerable distance from it. In some instances in breaking into these apparent walls, other bodies of quartz, or "splices," as they are often called by the miners, are found behind them, and there may be several such splices separated by smooth plane surfaces between the walls of the lode-channel. This feature makes it necessary to frequently cross-cut in order to be sure of not missing bodies of stone. Even after cutting through all the quartz bodies, however, it would not seem that the true walls of the lode-channel are always reached, for the country rock seems to be much broken and often full of strings of quartz,—has, in fact, the character of the "horses" of slate met with in lodes. Between Loane's and the main reef this is particularly noticeable, and while it is evidently to be expected in the country lying between two contiguous reefs, it also points to the possible explanation that these two are really one reef separated by a large "horse," the lode-channel extending from the hanging-wall of the Main reef to the footwall of Loane's. Both these walls appear to be better defined and more persistent than any of the numerous others met with between them, and the water traversing the rock appears to drain along them in preference to other channels. The "main hanging-wall," as it is called, is a particularly well-defined fissure. It was first struck at 70 feet from the surface in the main shaft. It is again met with in a small cross-cut to the east of the shaft at No. 1 level, also along the northern part of the drive on the main reef at No. 1 level, and again in the cross-cut east from the junction of Loane's and the Main reef at the same level. It has therefore on the whole a north-north-westerly course. It is again well seen in No. 3 level in the north drive on the Main reef, and is perhaps also seen in No. 5 level, but had not been bared enough to make certain when I saw it. It is generally very hard and smooth, and affords passage to a good deal of water, which deposits brown oxide of iron as it oozes out. The main footwall of Loane's reef is not so well-defined as this hanging-wall, but shows distinctly in several parts of the mine as marked on the plan. It is significant that the main hanging-wall has not been met with in the drive at No. 4 level east from the junction of the two reefs, and probably it lies still further east.

At No. 1 level there are some features of the mine to be noted. On the plan a drive is seen running to the westward in continuation of the cross-cut from the shaft to Loane's reef. This reef was met with sooner than was expected when being driven for, and the cross-cut was therefore extended through it to make sure that it was really the one looked for. A reef-channel was followed, from six inches to two feet wide filled with clayey lode-slate containing a little quartz. At about the distance where Loane's reef was expected a clayey head was cut through, which appears to be really the footwall of the reef. The cross-course followed runs right through this to the quartz portion of the reef, between which and the shaft it was no longer seen. After passing through the footwall the cross-cut still followed along the cross-course, the footwall of which makes a decided bend round to the north-west in the end of the drive. Nothing corresponding to it has been found in the cross-cut at No. 2 level below. It seems to me most likely to be simply a fracture of the country, extending probably from the Central to Loane's reef and formed at the same time as the main set of lode-channels. In the drive north on Loane's at this level the reef suddenly took a bend to the north-west, and while on this course carried neither quartz nor gold, but was filled with lode-slate. On bending to the east of north again the quartz was once more found. The break was at first taken to be a slide, but as no similar fault occurs in the Main reef nor in this one at the next level below, this cannot be so. The reef has a large "horse" in it at this point between the quartz and the footwall met with in driving westward, and the blank ground lies along the north side of this mass, which has wedged out by the time No. 2 level is reached. A very similar piece of dead ground is seen at the south junction of Loane's and the Main reef at No. 1 level, the channel of the former breaking suddenly across to join the latter, and being filled with lode-slate instead of quartz. The drive from this junction eastward to the main hanging-wall is worth noticing: it has followed a smooth wall carrying a little quartz and dipping to the southward. The country is pretty solid, but yet does not seem altogether undistributed, and in parts close to the smooth wall it is much contorted or puckered in minute folds of the thin layers of slate. The wall has every appearance of being a slide, but the Main reef passes through it without being heaved. What is clearly the same wall is met with again in No. 4 level, where, however, it is Loane's reef that goes on through it without dislocation. If the break had been a slide it might have been possible for it, under some circumstances, to have faulted the one lode and not the other, but it could not fault the one lode at one level and the other at a lower one: hence we see that it is not a slide at all, but only a break through the block of country lying between the reef-channels and the main hanging-wall. It is therefore probable that south of this break there is a large "horse" of country lying between the reef-channel and the hanging-wall, and there is a considerable likelihood of quartz being found in some parts along the latter if followed. To test this a cross-cut is being put in at the No. 4 level. The country in it, so far as had been driven at the time of my visit, was hard solid slate, apparently undisturbed. Should the hanging-wall be found as anticipated, but not carrying quartz, it will be advisable after following the reef-channel further south some considerable distance to again cross-cut for it, unless the reef turns more to the south-east and runs back towards the wall. The present workings may be merely the south end of a similar large "horse" which widens going northwards, and it is possible therefore that the south point of this new wedge of country may also be rich.

The southern extension of No. 1 level from the junction and that of the No. 4 are both in dead ground, the reef-channel being filled with lode-slate carrying but little quartz. The general parellelism of these two levels in their southern portions is very marked, as seen on the plan. The No. 1 level, however, does not show a feature which is well seen in Nos. 3 and 4 levels—namely, the junction of the lode-channel with another one coming in from the north-west. This is likely to be the Central reef coming in to join the Main line, and so probably connecting it with the Western reef. When this lode was struck at No. 3 level the winze on the Central reef at No. 2 level, which was standing full of water, was almost immediately drained.

In the north end of the mine the drives on Loane's reef have been generally short, not having been pushed any distance into the dead ground. The forking of this reef at No. 4 level is to be remarked. One branch runs about due north and underlays eastwards, the other runs nearly straight towards the workings of the North Golden Gate mine on what is nearly certainly a continuation of it. This western branch has a slight westerly underlay, as has also the North Golden Gate reef. (It is to be borne in mind that the No. 4 level of the New Golden Gate mine is nearly 100 feet above the level of the North Golden Gate cross-cut.) It does not seem that the east branch of Loane's reef continues its northerly course very far, as it would have been cut if so in the northern extension of the drive on the Main reef at the same (No. 4 level), which, as seen on the plan, runs considerably west of north. And if it turns west of north to any extent it is hard to see how it could fail to have been cut in the eastern North Golden Gate cross-cut, even allowing for the easting due to the underlay and difference of level of the two drives. Two possibilities therefore present themselves,—either the eastern branch of Loane's reef bends round to the north-west rapidly and rejoins the Western one before reaching the boundary between the New Golden Gate and North Golden Gate mines, or else it has only swerved a little to the westward, enough to make it still lie ahead of the drive on the Main reef. The former supposition implies an entire change of underlay of the northern part of Loane's reef, and I therefore think it much more likely that the latter is the true one, and that the eastern North Gate cross-cut would have to be extended still more to the east before it would reach the east branch. With regard to the western bend of the north part of the drive on the Main reef at No. 4 level, it is to be noticed that a footwall runs off to the east at the beginning of the bend (at the winze from No. 3 to No. 5 level), and that the quartz almost immediately gives out and is succeeded by lode-slate when the lode begins to turn, so that I incline to believe that the drive has left the main reef at the winze and followed a break in the country between the two lodes which connects their two channels, and consequently that if the drive were extended a very little further it would strike Loane's reef. The wall at the winze, if followed, might then lead on to a continuation of the Main reef stone.

The longitudinal sections, Plates 7 and 8, show that the body of auriferous quartz has been fairly continuous in both reefs from about 70 feet below surface downwards, and that it has a certain amount of pitch towards the south. In the Main reef, below No. 4 level, there was blank ground, as shown on the section down to No. 5, but at this level a new body of auriferous stone was encountered, which appears likely to be of great importance. In the way in which it was divided from the lode-slate filling of the dead ground by a clayey selvage, this quartz body closely resembled the one met with in the Old Boys mine at No. 3 level in No. 3 reef previously described. In the north end, at the time of my visit, two horses of country were causing this stone to branch, the best gold-bearing quartz being on the foot-wall. This "new make" of stone, as it is called, is a fine strong body of quartz, and will probably continue good in depth. It will be soon tested by the works from the 500-feet level now in progress.

It has been noticed by the mining manager, Mr. Thomas Andrews, as a general rule throughout the mine, that when the lodes bear towards the east of north they carry gold-bearing quartz, and when they veer round to the west of north to any considerable extent the quartz is replaced by barren lode-slate. There are a few minor exceptions to this rule, the most notable being the north part of the Main reef at No. 5 level, but on the whole, as may be seen by an examination of the plan, it holds good substantially all through the mine. In the Western reef, too, the gold-bearing stone was mostly obtained where it had a course a little east of north. While not disposed to agree that a rule may be founded upon this fact that the portions of the reef still unexplored running east of north are likely to be the gold-bearing ones, while such as bear west of north will be poor, still there are certainly grounds for such an opinion, and it will be of much interest to observe if the future workings prove the rule to hold good. Extension of the drive north at No. 4 level on the Main reef would be a convenient, and rapid way of testing it practically. If this lode continued on its north-westerly course it must have been cut ere now in the North Gate cross-cut, but as it has not been so cut it must turn again to the north or north east, and, consequently, by following it, it should soon be got again on the strike favourable for gold. As already mentioned, however, I am inclined to regard the apparent turn of the reef to the north-west as a break through the country to join Loane's reef, and to suspect that the Main reef has been left in the eastern wall of the drive; in which case the test of the hypothesis would be unsatisfactory.

In the New Golden Gate Company's section, 32-87G, and in the south-east part of 13-87G, a number of trenches and pits have been from time to time sunk on leaders and strings of quartz, more or less gold-bearing, marked on Plate No. 1, which appear to indicate a large lode channel or run of lodes going in a south-easterly direction from the main workings. Almost on the south boundary of Section 32-87G yet another reef has been got in some old workings from what is known as the Snake shaft, also running a south-easterly course. None of these have been worked at all recently. They seem to agree with the workings at the No. 4 level south in the mine itself, and with the course of the main hanging-wall, that the reef runs south-south-easterly from the main shaft. The main lode-channel appears therefore to be that of the Western reef, the north and south reefs (Loane's and the Main) being branches from it. It is not impossible, however, that these are faulted at the junction, and some cross-cutting might well be done south of it to try if this is the case, but there do not appear to be any signs on surface to indicate that it is so.

The exploratory work in this mine has been kept well ahead of the stoping, and there are large reserves of good stone above No. 4 level, while between Nos. 4 and 5 the ground is practically untouched, though proved by the levels and winzes to contain good ore. The stone in the bottom level is strong and good, and winzes are showing it to be continuing downwards equally well. In sinking from No. 5 level to No. 6 a gold-bearing leader was passed through in the shaft, two feet thick in the bottom, which may be the top part of a new make of stone on the footwall of Loane's reef, or, more probably, a dropper to the Central reef, in which case the latter is likely to be gold-bearing where it comes in. There is, therefore, an unusual amount of certainty that the mine will be remunerative for many years to come. I understand that it is intended to keep on sinking the shaft as fast as levels can be opened out, a policy which will prove the mine well in advance of the exploitation, and do much to render its shares a calculably safe investment. I do not think, however, that the exploratory work should be limited to sinking and opening up the present known ore-bodies, for driving through the dead ground on the course of the lodes ought also to be persistently carried on. The Company owns likely ground both north and south of the present workings, and there is every probability that, by driving along the reefs new ore-bodies will be struck. Driving north on the Main and Loane's reefs is specially to be recommended as most likely to be quickly followed by the discovery of payable stone. Both the Central and Western reefs also are worth further exploration, and while the mine is in a prosperous condition is the proper time to prospect them. Besides driving, a great deal of cross-cutting should be done from side to side of the reef-channels, and occasionally through from Main reef to the Western reef, for the experience of the mine has been that there are very numerous parallel lode-channels, and that these ramify so that it is only by constant cross-cutting that they can all be kept sight of.

The New Golden Gate Company possess what is certainly the most complete gold-saving plant in the Colony, having, in addition to the ordinary stamper battery, two Watson & Denny pans for crushing blanket sand and coarse tailings, and an installation of Frue vanners for saving pyrites. Moreover, in order to get the best results from the vanners these are not required to deal with the tailings just as they come from the battery, but have them classified into coarse and fine sands and slimes by a series of spitzbutten. Excellent work is thus secured in concentration of the pyrites. The battery is lighted with electric light.

From June, 1888, up to 31st July, 1892, 24,175 tons of quartz have been raised and crushed, yielding 27,009 ounces of gold, or an average yield of 1 oz. 2 dwts. 8 grs. to the ton, which realised £102,220 8*s.* 3*d.* For the six months ending 31st July, 1892, 96 tons of pyrites were saved by the Frue vanners from 7210 tons of quartz, or equal to 1⅓ per cent. The net profit resulting from the saving of pyrites amounted to £555 15*s.* 2*d.* The cost for the last half year of working the mine, including raising and crushing quartz, progressive and surface works, and all other expenses incidental to working the mine and managing the Company, is equivalent to £1 9*s.* 1½*d.* or 7 dwts. 17 grains of gold per ton of quartz crushed. The preceding half year the cost was £1 11*s.* 9*d.* per ton. The total amount paid in dividends now amounts to £36,000 and in dividend tax £1350.

North Golden Gate Mine.—Section 70-87G.—The workings of this mine are shown in plan and cross-section in plates 5 and 6. The main shaft is 7ft. 10in. by 3ft 10in., an awkward size for working, not permitting of two cages and a ladder-way as it should, and is 405 feet deep. Levels have been opened out at 150 feet and 392 feet. The upper one is almost on the same level as the No. 2 of the New Golden Gate, and the lower is a little below the No. 5 of the latter mine. A broken mullocky reef formation is said to have been got in the upper part of the shaft, and about 55 feet down some leaders were got carrying a little gold. At the 150-feet level a cross-cut has been driven east and west from the shaft. In the eastern cross-cut, which is 47 feet long, the end is in a broken mass of slate and quartz, the footwall of which is seen at 40 feet from the shaft striking N. 21° W. and underlaying to the east; this wall has been driven on north and south about 10 feet each way; it carries about 2½ feet in width of mixed slate and quartz, but no gold. The western cross-cut is driven 31 feet, and at 20 feet from the shaft passed through a body of quartz 3½ feet wide, carrying traces of gold. An almost vertical wall is exposed 12 feet from the shaft, with 8 feet of slate between it and the quartz vein. At the 392-feet level the eastern cross-cut is driven 82 feet from the shaft, cutting a few quartz veins, as seen in plan, but nothing of any consequence. The western cross-cut is 253 feet in length, and has cut near its west end a number of veins of quartz and clayey lodestuff, shown on the plan, which probably indicates that the Central and Western reefs of the New Golden Gate mine are close at hand. At 30 and 53 feet from the shaft two lode-channels have been passed through, and driven on as shown in the plan. These have smooth well-defined walls with clay selvages, but are filled with lode-slate and contain very little quartz so far as followed. Towards the south they probably soon join one another. Close to the New Golden Gate boundary a winze has been sunk to a depth of 64 feet, and in this some gold-bearing quartz was obtained. It was not in a well-formed body, but in lumps and veins,

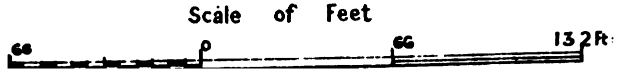

Scale of Feet
132 Ft:

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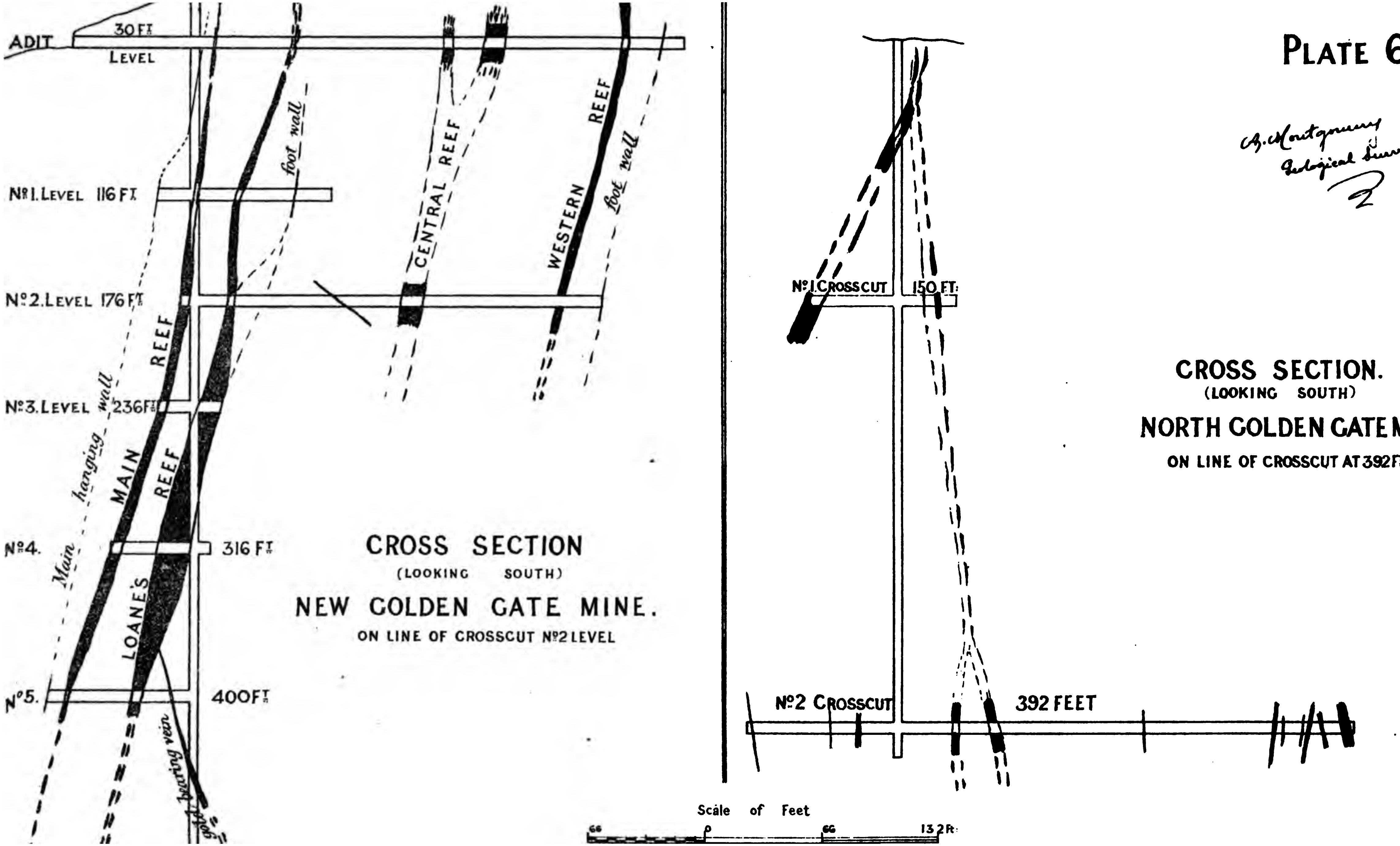
PLATE 6.

A. Montgomery
Geological Surveyor



CROSS SECTION
(LOOKING SOUTH)
NEW GOLDEN GATE MINE.
ON LINE OF CROSSCUT No. 2 LEVEL

CROSS SECTION.
(LOOKING SOUTH)
NORTH GOLDEN GATE MINE
ON LINE OF CROSSCUT AT 392 FT. LEVEL

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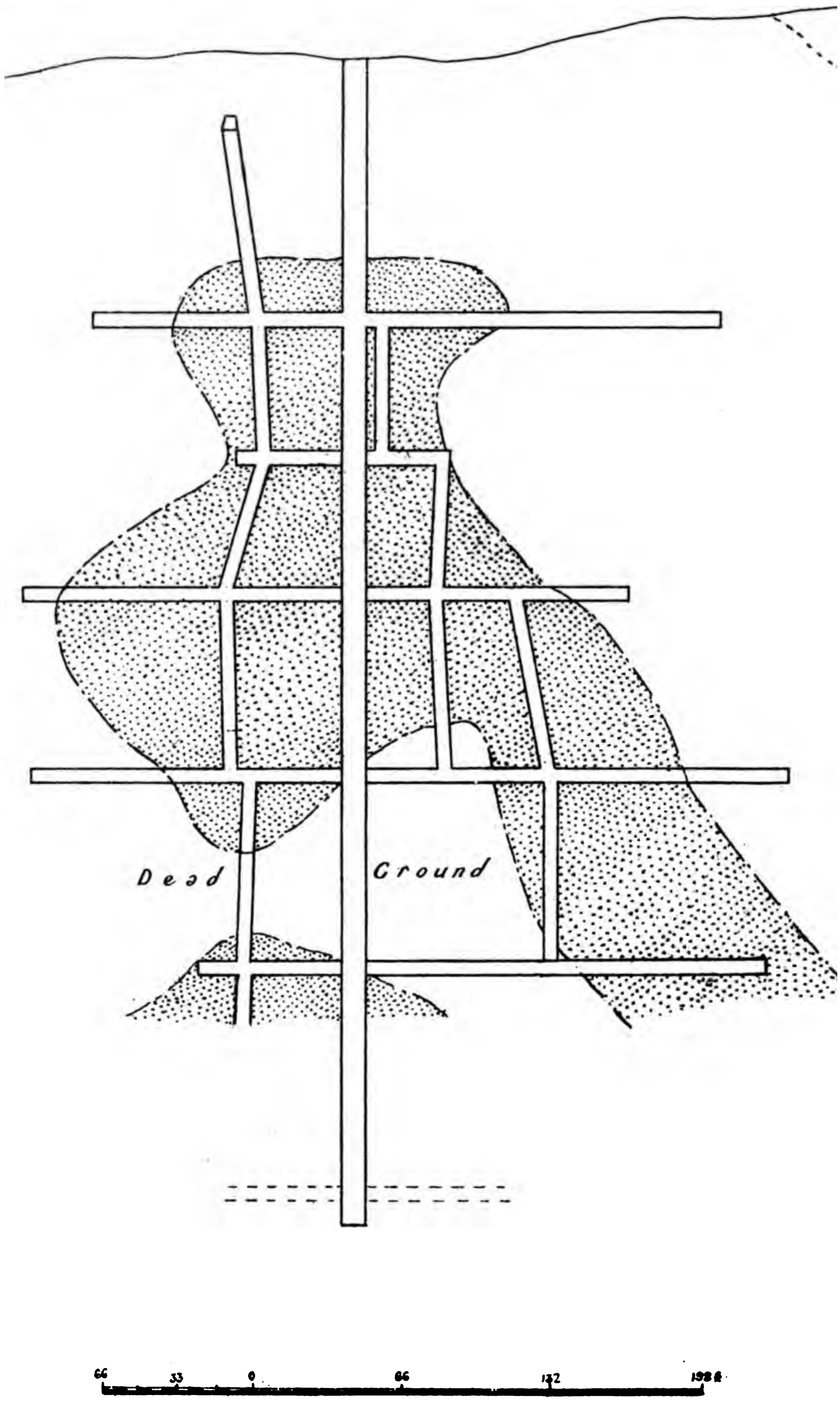
NEW GOLDEN GATE MINE

(LONGITUDINAL SECTION LOOKING EAST.)

MAIN REEF.

Dotted portion shows auriferous quartz body.



Scale 66 Feet to one inch

A. Montgo
Geologica

through much polished and twisted lode-slate of the same character as much of the dead ground in the New Golden Gate reef.

On looking at the plan, and remembering that the 392-feet level of the North Gate corresponds pretty nearly to the No. 5 level of the adjacent mine, it will be seen that if the New Golden Gate Main reef keeps its course it will run a little east of the eastern boundary of the North Gate section, and if it turns a little to the west of north, as the north ends of No. 3 and No. 5 levels render likely enough, it might come into the section. The end of the eastern cross-cut at the 392-feet level is 30 feet from the boundary, and the possibility of getting either Loane's reef or even the Main reef within this 30 feet seems to me to warrant the extension of the cross-cut to it. Should gold-bearing stone be struck even on or outside the boundary the reef above the level would underlay back into the North Golden Gate property, and a considerable block of valuable ground might be secured. The possibility of the reefs turning more to the west of north should also be contemplated, as this would bring them back into the section.

I have already discussed, when dealing with the New Golden Gate mine, the probability of the branches of Loane's reef seen at No. 4 level diverging further from one another or again reuniting. I have therefore only to say now that it appears to me that the following explanation of the various reef channels cut in the North Gate mine seems most in accordance with the facts we have knowledge of. The mullocky formation in the upper part of the shaft was Loane's reef, which is seen in a similar condition in the open workings on surface round the mullock shaft of the New Golden Gate. Going downwards this divides into two branches, one underlaying a little to the west, the other to to the east. The latter was passed through in the eastern cross-cut at the 150-feet level, which, however, was not extended far enough to cut the parallel Main reef; the former was also seen at the 150-feet level in the Western cross-cut, and is no doubt that passed through in the Western cross-cut at the bottom level, where it has again divided into two branches, which very probably will be found to reunite when followed.

Though the prospecting operations of this mine have so far been unsuccessful in finding payable quartz, it appears to me that there is very good inducement to continue the search for some time yet. The eastern crosscut at the 150-feet level should be extended to the boundary to try if possible to cut the Main reef, and that at the bottom level also to cut the eastern branch of Loane's reef. The cross-cut west should go still further to intersect the Western reef, and this should be followed by driving. The best hope of getting returns however, lies, I think, in following the western branch of Loane's reef seen in the bottom level, as the barren filling may at any moment give place to gold-bearing quartz. It would also be advisable to sink the shaft deeper, say another 200 feet, and again cross-cut to this reef. The gold found on the winze at the boundary may very possibly be a string from the ore-body in the New Golden Gate mine leading to another one at a greater depth in this mine. There is very good reason to hope for ultimate success if working is perseveringly carried on.

South Golden Gate Mine.—Two shafts known as the South Golden Gate and Pride of Mathinna shafts have been sunk in the Sections held by the South Golden Gate Gold Mining Company, the former on Section 295-87G and the latter on Section 361-87G. Both have been laid out to the south-south-east of the New Golden Gate mine in consequence of the various veins of quartz found on surface from time to time indicating a general trend of the reef in that direction, as above remarked in dealing with the latter. When I visited the field these shafts were not in work and had water in them, consequently I have not been able to get below, and the following particulars of the work done have been supplied to me by the mining manager, Mr. S. Richards. The South Golden Gate shaft is 10 feet by 4 feet in the clear, and has been sunk 205 feet. A level has been opened out at 200 feet, and driven about N. 65° E. a distance of 242 feet. At 153 feet in the shaft a reef was struck, and passed through at 166 feet, dipping easterly: it consisted of from six to eight feet of lode-slate with some quartz on the foot and hanging-walls, and is supposed to be the same reef as is seen close by on surface in the Snake shaft of the New Golden Gate Company's Section 32-87G. In the level this reef was struck again at 18 feet from the shaft, about 6 feet wide, and was driven on 32 feet 6 inches on course N. 25° W. It consisted of quartz and polished squeezed lode-slate, but contained no gold. At about 138 feet a slide was passed through, underlaying towards the shaft about seven feet in three. At 178 feet a large lode formation 25 feet wide was met with, underlaying westward about three feet in five; this was succeeded by 10 feet of country rock, and then another lode formation 13 feet wide and underlaying the same as the first was cut through. These lodes were filled with black greasy slickensided slate with occasional bunches of quartz, similar to that obtained in the North Golden Gate Company's winze and also in the Star of Mathinna Company's Mine.

The Pride of Mathinna shaft is 70 feet deep, and a drive has been made from the bottom in direction N. 73° E. for over a hundred feet. About 50 feet from the shaft a small reef 12 inches wide was cut, running north-north-westerly. This is also seen on surface in two trenches, in the southern of which it appears to have formed two branches 16 feet apart. The reef is underlaying eastward.

It is not possible, in the present state of our knowledge of the field, to form an opinion of much value as to whether these shafts are on or near the line of the New Golden Gate reef. As already stated, the surface indications would lead us to believe that this takes a south-south-easterly course from the junction in the New Golden Gate mine. If so, these two shafts would not be far from the line, and their getting load-stuff in about the position where it might be expected according to this theory is strong evidence of its truth. On the contrary, however, it may be urged that the underlay of the slaty lodes in the South Gate mine is to the westward, while the New Golden Gate reef has an eastern underlay. More work will have to done before there will be any certainty as to their identity. The South Gate cross-cut has only been driven some 242 feet, and the ground has therefore not yet been at all adequately prospected. From the position of the Sections held by this company the New Golden Gate reef can hardly fail to pass through either 295-87G or 360-87G, and extension of the cross-cut both east and west is accordingly to be recommended. The possibility of the north and south reefs of the New Golden Gate passing through or being faulted by the north-westerly ones is not altogether remote, though not, to my mind, very probable.

The stone from the old workings on the Snake Shaft reef in the New Golden Gate ground is reported to have yielded some 10 dwts. of gold to the ton, and as this reef continues strong in the South Gate workings it may at any time again become gold-bearing, and should therefore be driven on. The mullocky reefs ought also to be followed, far enough at any rate to give a good idea of their general strike. It is possible that they may be cross-courses and have nothing to do with the New Golden Gate reef. I should have preferred to have seen the shaft 200 feet deeper before any cross-cutting was done, and think that when the mine goes to work again it would be best to sink to 400 feet before opening out. The prospects of the mine seem to me good enough to put it in the category of legitimate mining ventures, in which it is often necessary to risk considerable capital for a problematical reward. Without such ventures mining would be at a standstill. This company has made a good beginning with its prospecting work, and it is to be hoped in the interests of the district that the shareholders will not lose heart on account of the want of immediate success, but determine not to abandon their undertaking without giving the ground a thorough trial.

New Golden Gate Extended, *Golden Ladder*, *East Golden Gate*, and *Star of Mathinna Mines.* (See Plate 9.)—It is most convenient to deal with this group of properties together, as their lodes are more or less related to one another. They are all on the slopes of the most easterly of the three main spurs on which the mines of this gold-field are situated. On the general plan (Plate 1) several shafts will be seen lying more or less in a line north from the New Golden Gate and North Gate shafts. The one in the south-west corner of 204-83 is a small prospecting shaft sunk to a depth of 60 feet in search of the New Golden Gate lode, but without any success. In the north-west corner of the same section is an old shaft, now full of water, said to be 120 feet deep. Quartz is reported to have been in former years obtained from this yielding (18 dwts. to the ton), and the lode is stated to have run about north and south. Near the eastern boundary of 209-87G is the new main shaft of the New Golden Gate Extended Gold Mining Company, 11 feet by 4½ feet in the clear, and 159 feet deep. This was shut down, and could not be got into for water at the time of my visit. The last 8 feet in the bottom was stated by the Mining Manager (Mr. W. M. Glass) to be mullocky lode-stuff. Two and a-half chains north from this shaft is a small old shaft sunk by the old Glencoe Company on a north-and-south reef, which may be the same as that worked in the old shaft in 204-83, but is more probably identical with a vein of quartz cut in the excavation for the New Golden Gate Extended Company's engine-house. A small adit, now used as a powder magazine, has been driven to cut this lode, and a little driving has been done along its course in the old shaft. The reef shows 3 feet or more of rubbly quartz, and has a slight underlay westward. A crushing taken out many years ago is said to have yielded 10 dwts. to the ton. The Star of Mathinna shaft is in Section 469-87G; its dimensions are 11 feet by 4 feet, and depth 157 feet. At 50 and 60 feet two gold-bearing leaders were passed through dipping westerly. A cross-cut has been opened out at 150 feet and driven S. 78° W. 63 feet. At 21 feet from the shaft a reef was cut 3 feet wide and driven on 21 feet S. 30° E., underlaying to eastward about 4 in 6. This consisted of fairly solid quartz with well-marked clayey walls. It contained no gold, and became small in the end of the drive and split up into leaders. At 44 feet from the shaft a lode two feet wide underlying west was cut, from which there was a considerable flow of water: no driving was done on this, as it contained no gold, and the formation was much broken. These particulars were given to me by Mr. S. Richards, the manager of the mine, as work had ceased for some time, and this shaft also was full of water. On the surface a reef of quartz is seen in three trenches, as shown on Plate 9, and an old shaft 30 feet deep has been sunk upon it. In the bottom of this the quartz divides into two branches, going downwards, one underlying east, the other west, something after the fashion of a saddle-reef. The quartz saved and lying at the main shaft is much mixed withh polished black slikensided slate, and several pieces of the white quartz are themselves rubbed quite smooth and bright by pressure and friction of one piece on another. The lode-matter was exceedingly like that from the winze on the North Golden Gate Reef.

It would appear, therefore, that there are veins of quartz running a more or less north-and south course, between the Star of Mathinna shaft and the New Golden Gate shaft. Taking this fact together with the evidence in the New Golden Gate and North Gate mines, it seems pretty clear that the Main reef of the former, if not Loane's reef as well, continues on a more or less north-and-south course. The various veins are probably similar to those met with in the surface strata of the New Golden Gate ground, which, it will be remembered, became solid reef at a lower level. Cross-cuts ought most certainly to be driven from the Gate Extended and Star shafts right across the line of these surface veins. It would be safer not to open out however above, say, the 200-feet level. It would be advisable also to cross-cut north-east from the Gate Extended shaft to cut the lodes seen in the old Caledonian adit to be mentioned presently.

A great many quartz veins have been found on the spur shown in Plate 9, and it is evident that it will be necessary to do a lot of work before it can be seen whether there are two or more main lines of reef, or simply numerous disconnected veins. The largest masses of quartz are those formerly worked by the old Caledonian Company on Sections 204-83 and 11-87G, now held by the New Golden Gate Extended and Golden Ladder Companies respectively. The adit put in by the old Caledonian Company and extended more recently is shown in Plate 9, and deserves considerable attention. What appear to be three closely parallel reefs have been exposed on surface by trenches, composed of from 18 inches to 5 feet wide of quartz. Old stopes 18 inches to 5 feet wide are still to be seen from which the quartz was extracted and crushed. The most distinct of these gives a course N. 75°W., and dip northerly of 73° for the reef, but, as shown on the plan, stone runs rather irregularly, though on the whole about N.W. and S.E. The quartz is said to have yielded payable returns for a time. In the adit country slate is passed through for 89½ feet, when we come to a wall crossing the drive on a N. and S. course, and dipping westerly 70°. Six feet further on there is another striking S. 30°E., and dipping westerly 68°. At 135 feet another wall is met with striking S. 20°E., and dipping the opposite way to the others, namely to the N.E. at an angle of 64°. In the roof of the drive the lode-stuff, broken clayey matter, and quartz, is pretty continuous between the first and last of these walls, but in the floor between them there is a mass of pretty solid-looking country rock. The lode-matter seems to form a sort of saddle reef over this piece of country. I take it all to be one formation from 89½ to 135 feet. This reef does not appear to have come to surface at all, and I am therefore inclined to regard it as portion of the flat reef seen further in. At 143 feet a large reef is met with consisting mostly of broken clayey country rock on the footwall side, but nearly all quartz towards the hanging-wall. The footwall strikes N. 20°W., dipping N.E. 70°, and the hanging-wall has strike N. 18°W., dip N.E. 72°: the

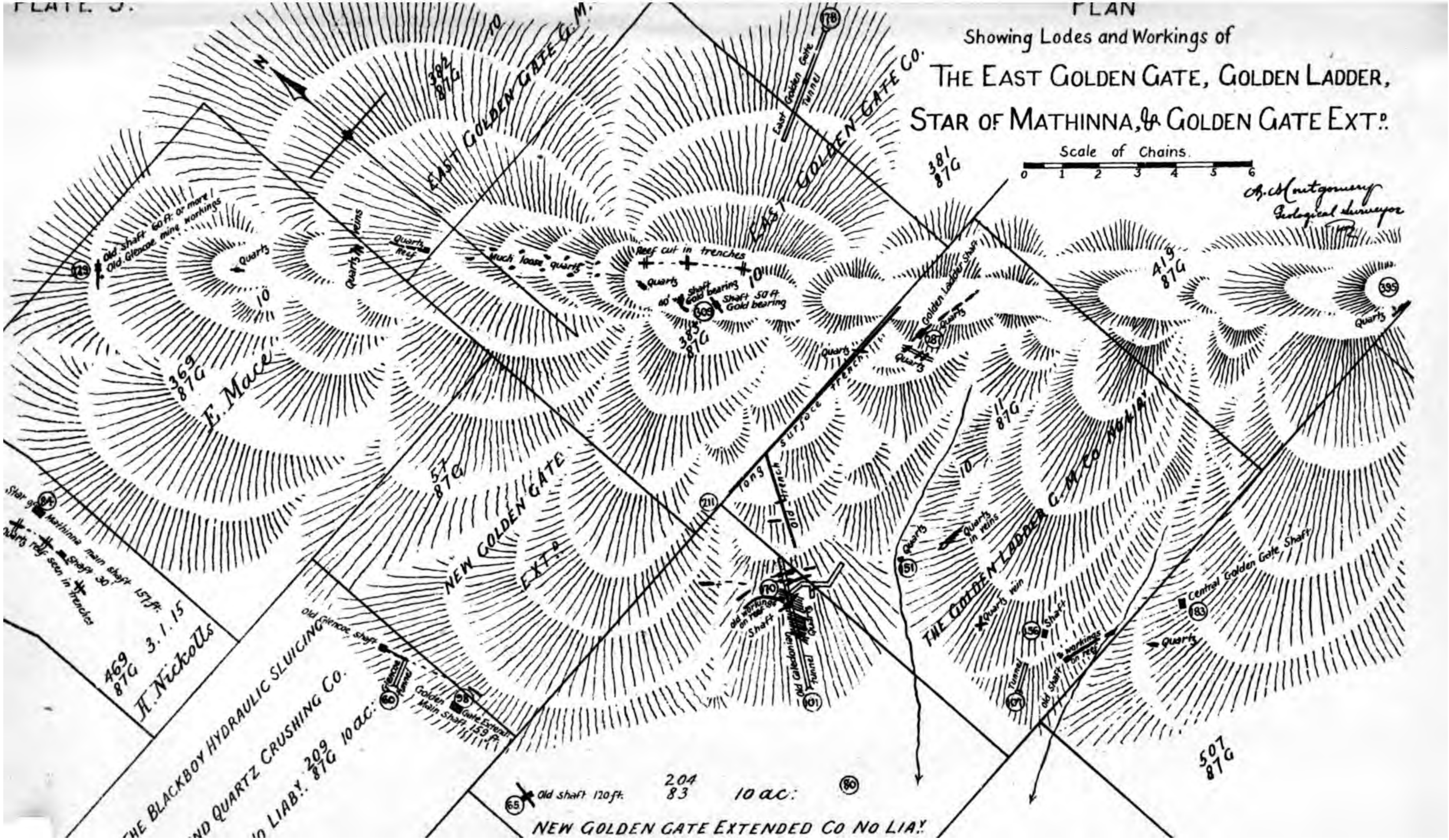


PLATE 5.

PLAN

Showing Lodes and Workings of

THE EAST GOLDEN GATE, GOLDEN LADDER,

STAR OF MATHINNA, & GOLDEN GATE EXTD.

A. Montgomery
Geological Surveyor

latter was cut at 169 feet from the entrance to the adit. A shaft had been sunk from the surface workings on this lode, but is now walled up, and I cannot therefore say if it went deeper than the adit, or if there were any workings from it. At 191 feet in another reef is cut, striking N. 45°W., and dipping S.W. 78°. It consists of from 12 to 18 inches of quartz, and appears to be one of the reefs seen in the trenches on surface: from its underlay it should join the shaft reef at no great depth. Between the latter and it, and apparently cut short off by both of them, there may be followed along the sides of the drive a flat vein of quartz from two feet to four feet in thickness, which sends off numerous stringers into the country. This flat vein waves about very much, being now in the roof and again in the floor. The saddle-shaped reef first met with in the adit is probably a part of it where it makes a more sudden bend than usual. Between the reef cut at 191 feet and another at 203 feet the flat vein is not seen, being most probably either above the roof or below the floor of the drive, but it is seen again past the latter in the end of the adit. Between these two reefs the country rock appears but little disturbed, and the beds of slate are well marked and strike N. 30° W. dipping N.E. 86°, thus conforming to the general strike and dip noticed in other parts of the district. The lode at 203 feet strikes N. 55° W. and dips N.E. 70°, or in the opposite direction to the one preceding it: it has been driven on six feet to the north-west and 14 feet to the S.E. The lode-channel is from three to four feet wide, and is mostly filled with mullock containing strings of quartz: on the east side of the drive, however, there is about four feet of quartz on the hanging-wall. The footwall portion consists of two smooth greasy black walls from eight to sixteen inches apart, with soft clayey mullock between them. Both this and the preceding lode if they keep their course must shortly run into the main lode, and the turn of the surface workings towards the west very likely indicates the point of junction.

Leaving the adit at the hanging-wall of the shaft reef, a drive has been extended a little south of east into the Golden Ladder Company's Section. This has followed the flat vein, which is very much crumpled and irregular along its course. It appears in places to be sending a more or less vertical offshoot up into the roof, and is generally from a foot to 18 inches in thickness. At 76½ feet from the adit a quartz vein two to six inches in thickness runs north-easterly across the drive: it dips S.E. about 83°, and at 94 feet a winze has been sunk 60 feet on it by the Golden Ladder Company. At 82 feet a clayey head running N. 25° W. and dipping N.E. 83°, apparently a bedding plane of the slate country, cuts off the flat vein, but traces of it reappear further along the drive. If this were extended a little further it would cut the two lode formations met with at 191 and 203 feet in the adit. The flat vein, or blanket vein as such are often called, is a feature in these workings not very commonly met with. It must be older than the more vertical lodes as these cut distinctly through it and fault it. It has been a very troublesome vein to follow, and appears to have diverted attention from the more promising true lodes. A somewhat similar flat vein has been found in the Jubilee mine, as will be described further on.

The shaft reef is a strong body of quartz, and was auriferous in the upper portions; the other two lodes further north-east in the adit also appear to be well defined fissure veins; there seems to me, therefore, every reason for following them downwards. Their appearance is quite as promising as is that of Loane's reef or the Main reef of the New Golden Gate mine at much about the same level in the surface adit. Cross-cutting to the north-east from the New Golden Gate Extended shaft would probably cut the line of reef in not more than 360 feet, but I think it would also be well to sink a deep winze on the stone itself from the adit. With a good shaft already in existence not more than 600 feet away in a direct line from the old workings, it would not be worth while to sink a fresh one near the mouth of the adit to prospect these reefs, as the work could be better done by cross-cutting them from the main shaft and then driving along the lode-channel at not much greater cost. This appears to me to be work which has a very fair chance of a successful issue, for all over this spur veins of auriferous quartz have been obtained from time to time, and there cannot be the least doubt therefore that the country is favourable for gold.

In the Golden Ladder Company's Section 11-87G some quartz veins have been cut on surface very much on the line of the outcrop of the above reefs, but no work except very shallow trenching has yet been done on them. It may be remarked that there is a considerable likelihood that there is a junction of a north-north-westerly lode, with one or more running north-westerly at the old working, as a short drive S.W. from the drive on the flat vein, shown on plan, has proved that the main reef on which the shaft is sunk, has not turned back to a south-easterly course inside of 40 feet from the adit, at any rate, and is therefore likely to continue on much the same bearing, S. 18° to 20° E., as where passed through by the adit. The veins of quartz in the S.W. corner of 11-87G are not unlikely to be leaders from this main reef. The old shaft and workings shown here on the plan were also made by the old Caledonian Company, and are said to have yielded some very fair quartz, but are not now accessible. The workings were about 40 feet deep near the old shaft, but got shallower going towards the little creek. Where the line of reef crosses the latter there is a great deal of barren quartz exposed for a width of about 18 feet. A shaft has been sunk on the line of this reef, known as the Central Golden Gate shaft (not working at the time of my visit), but no quartz appears to have been yet got in it. Lower down the hill, however, in an old trench can be seen a lode about 5 feet wide of broken slate and rubbly quartz underlaying to the north-east, which is probably a branch from the same line of lode. A small prospecting shaft has been lately sunk by the Golden Ladder Company, and a short tunnel driven as shown on plan, but work on these had been abandoned without any discoveries of value having been made so far as could be seen. The tunnel is probably to the north of the line of reef worked in former times, and therefore will not cut it at all.

On the top of the spur, about the middle of the south boundary of Section 419-87G a lode has been cut in a shallow pit, which contains some gold, and has a very kindly appearance. As far as can be judged from the very poor exposure presented, it runs about W.N.W., and may, therefore, be connected with the north-western line of reef seen in the Old Caledonian adit. Some work will have to be done, however, before its course can be even approximately made sure of.

Along the crown of the ridge running through the centre of Section 383-87G, several gold-bearing veins of quartz have been discovered, and a little desultory work has been done. The Golden Ladder Company have sunk a shaft (full of water when I saw it), and made several trenches on some quartz veins shown on the plan. These do not appear to form a well-defined reef at the present elevation, but may come together when solid unaltered country is met with at a depth. In the shaft from 2½ to 3 feet in

width of rubbly quartz may be seen, running nearly E. and W., and dipping northerly. Very
prospects of gold are reported to have been obtained while sinking. The direction of the veins on su
is a little to the north of west, but they have not been cut in a long trench run from the N.W. corne
11-87G to the crown of the ridge, except in one spot, which would give north-west as their general dire
if the stone cut in it were the same as that in the shaft. In this long trench the country rock has
thoroughly laid bare, and there is very little chance of any veins of quartz worth mentioning having esc
notice.

Section 383-87G is one of several held by the East Golden Gate Gold Mining Company. Two
shafts have been sunk in it right on the top of the ridge, on gold-bearing veins; but the course and u
lay of these is not at all well defined as yet. There appears to be a line of reef running along the
nearly N.W. and S.E., for a great deal of loose quartz is strewn all along this line, and veins of q
have been cut in several trenches all running more or less along it. It is probable enough that the G
Ladder veins last mentioned also belong to this lode system. Remembering that the outcrop of Lo
Reef is a very similar mass of irregular leaders interspersed through country rock, there is a conside
chance of there being a strong reef below here also. To test this an adit has been begun by the
Gate Company, but will have to be carried 200 or 300 feet further before it will reach the probable li
lode. It is very doubtful if this adit will be of any use when put in, as it appears necessary in this di
to attain depth before the lodes can be found solid and undisturbed, and instead of continuing it I thi
would be better to sink a shaft and cross-cut to the reef channel. A deep cross-cut, from side to sid
the hill, from such a new shaft to the New Golden Gate Extended shaft, would not be a very heavy u
taking for the two companies concerned, the distance being very little over 1000 feet, and would be a
valuable prospecting work. By arranging to begin driving from the East Gate shaft to cut the supp
lode under the ridge, and from the Golden Gate Extended shaft to cut the reefs seen in the Caledonian
at the same level in both cases and along the line connecting the shafts, each company would perfor
piece of prospecting very necessary to be done in its own ground in any case in such a way that
unknown piece of country lying between the two lines of reef could be rapidly and easily prospected a
wards by extending the drives.

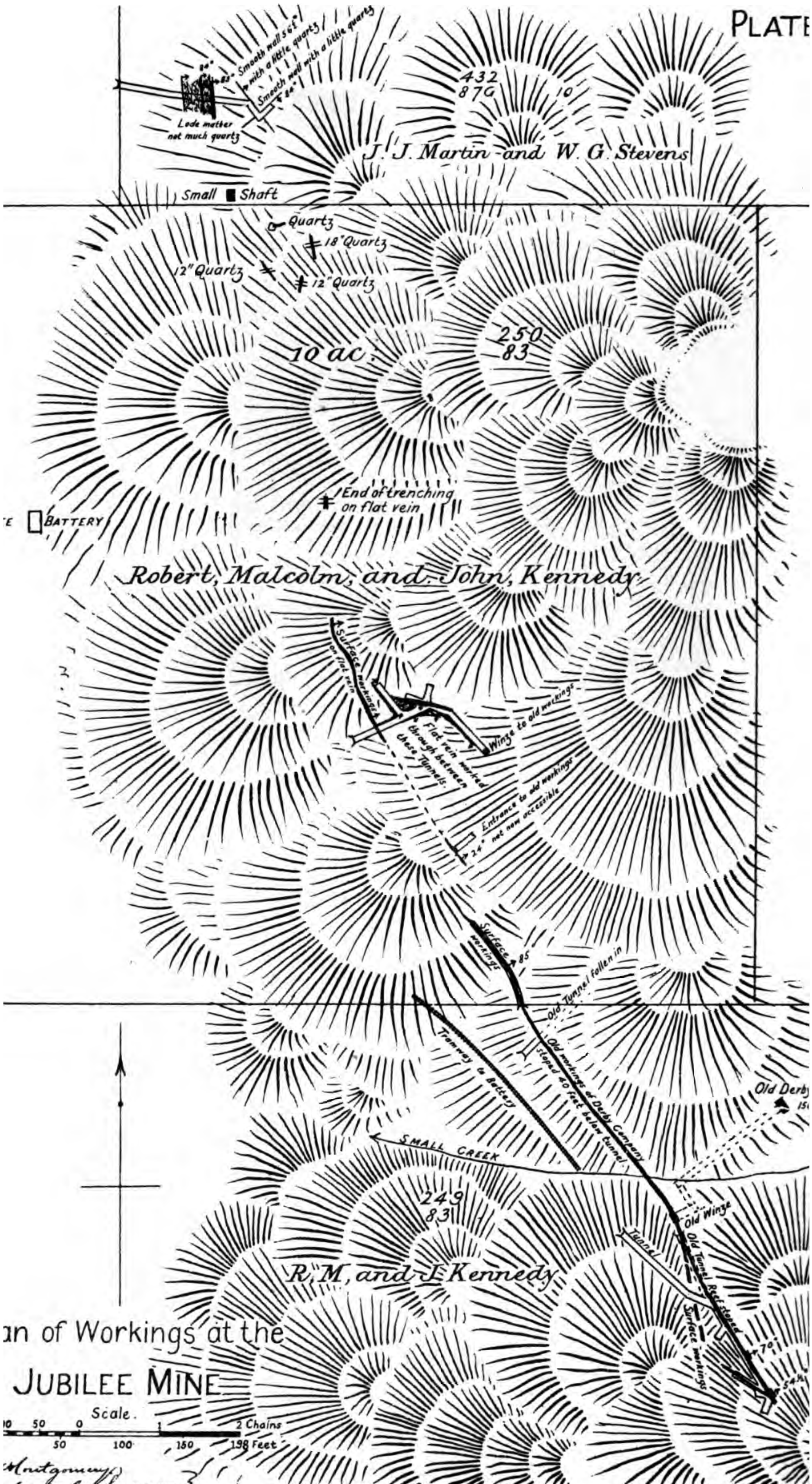
Near the north boundary of Section 369-87G a small cross-lode running N.E. and S.W. was form
worked by the old Glencoe Company, but I have not been able to learn with what success. The old u
lay shaft appears to be over 60 feet in depth, and the stone seems to have been from 18 inches to 3 fe
thickness, according to the width of the old stopes. If this lode continues it should join the St
Mathinna reef near the main shaft.

Golden Stairs Mine.—This is another of the old mines formerly worked in small way near the su
which has been lately reopened. The reefs are found in Sections 253-87G and 386-87G as shown on
General Plan, Plate 1. A main shaft has been sunk to work the reef on which the old Royal Stan
Company formerly operated. The old workings consisted of two shafts, 53 and 30 feet deep respecti
sunk on the reef, and between these the ground was stoped to surface, it is said with very good res
Another old shaft 2½ chains further north appears to be a shallow one, and to have had no stoping
from it. To the northward from this the reef has been traced by trenches for several chains, till
covering of superficial alluvial matter became so deep as to interfere with its being traced further.
outcrop is generally rubbly and rusty quartz with much clayey matter. South of the old working
chains the reef has been traced to a point where it junctions with another smaller one running more to
north-west, which has been found again in a trench 5 or 6 chains away; south of this junction it does
appear that any sign of the reef has been seen. It is said that £1500 worth of gold was got in
shallow alluvial workings north of the shaft, much of which was little water-worn, and may have c
from these reefs. While the alluvial work was in progress, another reef running east and west
discovered, and worked for over a chain along the surface, yielding good gold in the capping. This
known as the Welcome Stranger reef. Specks of gold are even now to be seen in occasional pieces of
rubbly outcrop. A small shaft was sunk some 45 or 50 feet, and a drive put in to cut the reef, but
unsuccessful in finding gold, whereupon further search was promptly abandoned and the shaft allowe
fall together.

The main shaft of the Golden Stairs mine is east of the old workings, and has been sunk 165
it is 11 feet by 4 feet in the clear. At 150 feet a cross-cut has been driven S. 72° W. to cut the reef;
had only been advanced 58 feet at the time I saw it. The shaft was sunk in slate country, but the c
cut at 28 feet struck sandstone, and from there onwards the rock was alternate bands of slate and sands
underlaying 1 in 4 towards the shaft or north-easterly, and striking N. 35° W., thus having the ge
strike and dip of the district. Since my visit the reef has been struck, and the manager, Mr. W
Stevens, has kindly sent me the following particulars:—"Since your visit here we have extended the c
cut west a distance of 40 feet, the last eight feet of which passed through a formation 8 feet wide,
bearing from wall to wall. Where passed through in cross-cut the formation was composed of one foo
stone on footwall, 4 feet of sandstone and quartz leaders in centre, and two feet of quartz and one fo
flucan on hanging wall. We have driven 40 feet north on lode, and the footwall portion of lode has v
from 1 foot to over 4 feet in thickness. The mixture of sandstone and quartz, and the hanging wall q
have cut out. The lode seems to be composed of makes or splices of stone. The lode so far has pr
far wider and richer near bottom of drive than elsewhere, which leads me to think we are near the ca
a large payable body of stone, consequently I have recommended the sinking of shaft another 100
which ought to test it.................I may state the lode is trending nearly north and south, and ha
underlay of 2½ feet in 6 feet west."

It may be worth noting that this lode is on much the same course, underlay, and line as the we
branch of Loane's reef passing through the North Golden Gate mine, and that this line, if continued s
ward, passes a little east of the South Gate shaft near where the mullocky lodes were cut, and still fu
south comes fairly upon the line of the Jubilee main reef. These need not necessarily be connected, b
the same this line should be well prospected in case the reef is continuous right along it. Even i
altogether continuous it is probable that lodes will be found off and on along this line.

PLATE



84°
83°
Smooth wall 56½°
with a little quartz
Smooth wall with a little quartz
84°
Lode matter
not much quartz
432
876
10
J. J. Martin and W. G. Stevens
Small Shaft
Quartz
18" Quartz
12" Quartz
12" Quartz
250
83
10 ac.
End of trenching
on flat vein
BATTERY
Robert, Malcolm, and John, Kennedy
Surface workings
on flat vein
Flat vein worked
through between
these Tunnels.
Winze to old workings
Entrance to old workings
24° not now accessible
Surface workings
85
Old Tunnel fallen in
Tramway to Battery
Old workings of Derby Company
stoped 40 feet below tunnel
Old Derby
SMALL CREEK
249
83
Old Winze
Tunnel
Old Tunnel Reef stoped
Surface workings
70°
54½°
R, M, and J. Kennedy
an of Workings at the
JUBILEE MINE
Scale.
50 0
50 100 150 198 Feet
1 2 Chains

Golden Spur Mine.—This had been shut down for some time when I visited the District, and I could not examine the workings in consequence of their being full of water. Very little is to be seen on the surface. The main shaft, over 100 feet deep, 10½ feet by 4 feet in the clear, is situated in Section 333-87G. It was sunk on a vein of gold-bearing stone from which fair prospects were obtained. The same vein has been traced to the south-east into Section 404-87G, where, however, it is very small, only ½ to 2 inches wide. The walls are pretty well defined nevertheless, and dip S.W. 64°. It seems very possible that this is a leader from a main reef further east. On Section 356-87G a prospecting shaft has been sunk close to the cemetery, about 100 feet, to further test the reef seen in an old shaft known as Moore's, which is close beside it. This old shaft was some 60 feet deep, and some stoping was done from it, the quartz being said to have been payable. The strike of the reef, as far as ascertainable from the old stopes, is S. 30° to 35° E., and it has a very slight underlay eastward. The old stopes are about 2 feet wide, and the walls are well defined. I am not aware if any driving was done from the new prospecting shaft to cut this reef below the old workings; if not, it seems worth doing. If the reef continues on its course it will run into the New Golden Gate ground at the western reef, and it is therefore not unlikely that these two are identical. The line joining them is worth a trial.

Jubilee Mine.—The lodes and workings of this mine are shown on Plate 10 as far as I was able to enter them, several old drives being now fallen in. The workings are on Sections 249-83 and 250-83. The ground was formerly worked by the old Derby Co., who were successful in obtaining some very rich quartz in their main reef in the north part of 249-83. They worked from the surface downwards and drove south into the high hill in the southern Section, and later on sunk a main shaft to a depth of 150 feet, and drove from it to the reef and along the latter to connect with a winze sunk from the workings above. The reef was, however, poor and much broken at this part, and work was soon abandoned. The timber was unfortunately drawn from the upper part of the old shaft, and it would probably now be rather difficult to repair for the purpose of further exploring the reef as ought to be done, the former trial having been a very insufficient one. The old stopes went about 40 feet below the tunnel shown on the plan; the stone was small, about 7 or 8 inches wide only, but often very rich, but got too small and too much broken to work, and was therefore abandoned. In the end of the tunnel a vein of quartz comes in from the north-west 12 to 15 inches wide, but very poor in gold, dipping 82° to the south-west. At its junction with the main reef a winze has been sunk in which a large and strong body of quartz 5 feet wide is visible. In another winze further back along the drive the main reef is from 8 to 12 inches wide; in both it is very poor. Seeing that this reef has been a rich gold-bearing one in parts, and appears to be making into a strong mass of quartz in the south end, it deserves further prospecting. This would now be best done at some depth, from a main shaft. The possibility of this reef being part of a line of reef running through the South Golden Gate, New Golden Gate, and North Golden Gate mines and on to the Golden Stairs has already been referred to above.

A party of tributors have lately traced this reef a little further north by means of a deep trench and shallow drive along its course, but it is both narrow and poor in gold. These appear to be the last workings north on the true Derby reef, which, I take it, has nothing to do with the flat reef found a little further to the northward. As will be seen from the Plan, the main reef probably lies to the west of the two tunnels put in on the flat reef, and therefore has not been intersected by them. The outcrop of the flat reef happens to be almost on the same line as that of the Main reef, but I do not think there is any other connection between them. The flat reef has been a good deal worked; it is very much like that found in the old Caledonian tunnel previously described, dipping and rising into very irregular hollows and hills, and sending off strings of quartz into the country in much the same way. It has been gold-bearing, but not rich, and a good deal of quartz has been crushed from it. The difficulty of extracting the stone from so undulating and flat-lying a body, and of knowing where to look for it if lost sight of for an instant, are greatly against much mining being done upon it. In my opinion the best work for this property to take in hand is to try to trace the main lode north and south, and sink a main shaft to test it at lower levels.

There is a small battery on this mine, the crusher used being a Huntingdon mill. The tributors had been burning the quartz to render it more friable, a fact which confirms the local opinion that this mill is not altogether successful in dealing with hard quartz. The plant is sufficient for testing purposes, which is all that is required in the present position of the mine.

Section 432-87G.—The work done on this section is also shown on Plate 10. A good many veins of quartz are seen about the surface, and a small shaft has been sunk a few feet where shown on plan, but the only work of any consequence that has been done has been the driving of an adit, known as the City P.A. tunnel, from the western boundary of the section. At 53½ feet from the entrance a soft mullocky lode was met with and driven through for 26 feet. Two distinct smooth walls, one of them the hanging-wall, are seen, which agree in giving the strike of the lode as N. 5° W., and its dip as 83° or 84° to the eastward. There is a good deal of quartz mixed with the mullock and pug, but no gold was found in it, though it contained a good deal of pyrites of favourable appearance. I think it would be worth while doing some more work on this lode to see what it would lead to, for it is not unlike some of the softer portions of the New Golden Gate reefs, and also answers the description of the mullocky lodes passed through in the South Golden Gate cross-cut, and its position is very nearly on the line connecting the Golden Stairs reef with the Jubilee main reef, so that it may prove to be a part of a main line of lode. It would be interesting to trace it southwards and see if it had any connection with the Jubilee reef.

In the end of the tunnel two smooth hard walls, carrying a little quartz and flucan upon them, were encountered, cutting each other nearly at right angles, but apparently not faulting one another. One dips north-westerly 56½°, the other south-easterly 84°. It is very possible that either or both of these may fault the mullocky lode or be thrown by it. The north-easterly one in the face shows about four feet of broken curly slate and soft mullock, and water depositing iron oxide oozes out along the footwall. It therefore closely resembles portions of the Boys and New Golden Gate reefs that are filled with lode-slate. Further developments in this tunnel are likely to be interesting.

Telegraph Mine.—Almost due west from the City P.A. tunnel, on the other side of Long Gul
an adit known by this name : it has been put in to cut some gold-bearing veins found on the top
ridge along the boundary between Sections 418-87G and 417-87G, and has been driven 161 feet th
hard slate and schist country. No lodes have been cut in it, though several irregular veins and buncl
quartz have been seen, and it will have to go another 260 or 270 feet before reaching the shaft for wl
has been driven. This is 55 feet deep, and has been sunk on a vein of rubbly quartz 12 to 18 inches
which is stated to have yielded fair prospects when sinking. The vein appears to run N.W. and S.E
has been traced S.E. some little distance by trenches. All along the spur for some distance north o
there is a great deal of loose surface quartz, and it is rather probable that a considerable northerly
yet to be found. No work was being done in this mine at the time of my visit, the failure of the Ba
Van Diemen's Land having been the cause of stopping operations in it, as in several other ca
the district.

Lady Mary Mine.—Sections 411-87G and 408-87G. This mine is situated north-west from Mat
township and on the opposite side of the South Esk, being in what is called the Dan's Rivulet Gold
By road it is about four miles distant from Mathinna. The mine was worked some years ag
abandoned after a very short trial, and is now being again re-opened. A new shaft has been sunk 10
and is to be put down still further before driving for the reef. The workings are near the eastern bou
of Section 408-87G, and about half way from the north and south boundaries. The reef runs N. 5
and dips S.E., but there also appears to be a branch dipping away to the north. The old workings c
of an underlay shaft 45 feet deep, from which stoping has been done N.E. and S.W. for a total dista
about 150 feet. At the N.E. end, 57 feet from the old underlay shaft, there is a small shaft about 2
deep, in which the reef appears to be bending round to an east and west course, and a little south o
from this, at a distance of 78 feet, a reef has been cut in a prospecting shaft 25 feet deep recently sunk
this there are about 18 inches of quartz carrying a little gold, but I do not think it is more than a b
of the main reef. In the south-west end of the old workings the stone appears to have got very
On the north-west side of the workings opposite the old underlay shaft, some quartz running parallel
main reef at a distance of some 20 or 30 feet has been worked and a few tons of quartz extracted
shows that the entire lode formation is probably considerably wider than the veins of stone worked
points to the necessity of frequently cross-cutting from wall to wall. In the underlay shaft the r
about three feet wide in the south-east end, and underlaying S.E. 1 in 3 ; in the opposite end there i
quartz underlaying the opposite way which has not been followed. According to the information I re
the stone obtained by the former owners from the underlay shaft yielded about eight dwts. of gold t
ton ; and in the stopes S.W. from it better quartz was found, some of it yielding over two ounces to t
when crushed. A good deal of black oxide of manganese is contained in the stone, which inte
considerably with the amalgamation. The amount of work done by the old company was quite inade
to give a fair trial to the reef, and the results obtained, if correctly reported, are in my opinion
sufficient encouragement to justify the present owners in re-opening the mine. The country rock i
new main shaft is a soft yellowish sandstone, the solid unaltered country not yet having been reached.

South of the workings there is found over a large area of the surface a great deal of oxide o
carrying angular pieces, and occasionally distinct veins of quartz which appears to be of a lode char
Owing to very wet weather setting in I was not able to trace this out satisfactorily. It appears to h
trend N.W. and S.E., and will cross the line of lode a short distance S.W. from the end of th
workings. No gold has been found in it. In the main shaft occasional veins of ferruginous matter si
to this have been passed through, which confirm my idea that it is of lode character. When intersect
the new workings it will probably be more clearly visible, and it will better appear if it is worth doin
work on it.

On Section 151-87G a soft lode 4 feet wide of rubbly quartz containing a little gold has been c
the south west of, and very much on the line of, the Lady Mary reef. A few feet north of this hard q
with much contained oxides of iron and manganese is seen, but does not appear to be gold-bearing.

On the road from the old Lady Mary battery (removed long ago), to the mine we pass over
alluvial ground which must be an old terrace of gravel deposited when the South Esk had not cut its
down to the present level. There is a good deal of this alluvial matter about the lower slopes of the
and it is very probable that in parts there will be more or less gold in it.

Very wet weather coming on I was obliged to defer further examination of this portion of the
field. A good deal of prospecting is going on, and there are several old claims which in former days
more or less gold, so there is a probability of good reefs being discovered any day. As in the Matl
field proper, however, I think that it will be necessary to sink well below the oxidised superficial
before the lodes will be found to be well defined and permanent.

Some general conclusions may now be drawn as a result of this examination of the Mathinna gold-
The country rock is highly auriferous, gold having been found in it in every direction, not only in de
reefs but also very commonly in innumerable small veins. The number of well defined reefs is very
siderable, and though no line has been traced with certainty over any very long distance, there is reas
believe that this will yet be done in more than one instance. The New Golden Gate, Black Boy,
City of Hobart lines all appear to be fairly persistent in strike. The very commonly heard statement
there are two sets of reefs at Mathinna, one north and south, the other east and west, is seen by a gla
the plan to be very far from accurate, most of the reefs diverging so considerably from the cardinal
as to make it quite misleading. The strike of the reefs does not appear sensibly to affect their gold
good stone having been found in the New Golden Gate, New Eldorado, Old Boys, Jubilee, City of H
and Lady Mary mines on widely divergent courses, showing that the direction of a reef is no criteri
its gold-bearing capacity. (I may remark here that the belief once very commonly held that reefs ru
north and south were likely to be richer than those on other courses has long been exploded by facts, th
it lingers in existence still along with such curiosities as the notion that all good reefs live on the sunn
of hills.) The observed fact that in the New Golden Gate mine the gold is found almost invariably

course east of north, and hardly ever when the reef turns to the west of north, may prove to be a reliable rule in that particular mine, but I do not think is likely to be a general one throughout the district. No one class of country rock, as, for example, sandstone, hard or soft slate, or schist, has yet been proved to be more favourable for gold than any other in this district. In the auriferous quartz, iron, and arsenical pyrites and galena, also sometimes blende, are commonly associated with the gold, and these sulphides appear themselves to be auriferous and well worth saving by concentration. Sufficient development has not been done to establish any rule as to whether the junctions of reefs are here richer than other parts, but there is considerable evidence that such is the case, and as this feature is one very commonly found in lodes elsewhere, it seems advisable to find and well prospect all junctions. The New Golden Gate rich stone is at the junction of the Main and Loane's reefs and not far from the junction of both with the Central reef. The Black Boy mine gave its best gold at the junction of its two reefs, and the gold now being got in the Old Boys' mine is probably not far from the junction with the Black Boy line. The City of Hobart rich stone was also at the junction of two reefs. The New Eldorado and Jubilee rich quartz does not, however, appear to have been near any junction, and the above instances may be only coincidences. The workings of all the mines have shown that in the higher levels the reefs are very generally considerably disturbed, the quartz being of a rubbly nature and liable to be very patchy in gold. It is seen at the same time that the country rock has been subjected to atmospheric influences which have effected a good deal of chemical change, oxidising iron compounds, removing soluble constituents, and softening and changing to clayey matter rocks which at greater depths appear as hard blue slates and schists. There can be little doubt that this chemical change is accompanied by more or less change of volume leading to swelling or contraction of the ground, and resulting in the disturbance of the superficial strata which is sought to be explained. In the New Golden Gate mine the change from the yellowish country to the blue unaltered rock takes place at about 70 feet from the surface in the shaft, and it was not till this level was reached that the reefs became solid masses of quartz. The connection between the superficial alteration of the country and the fragmentary and unreliable nature of the reef in this instance is so marked that it seems justifiable to consider that the same change will take place in other cases also. For this reason I take it that prospecting to be of much value must in this district be at a depth well below the level of atmospheric influence. The success of the New Golden Gate mine in finding solid rich quartz at a depth below a reef formation, which on the surface consists merely of leaders and strings of quartz mixed with clay and country rock, should encourage the owners of such properties as the East Golden Gate, Telegraph, and others, which show large quantities of loose rubbly quartz on surface, to sink deep upon them. A fortunate fact which makes mining from shafts very much easier at Mathinna than in many other districts is that so far as experience has gone there is but little water in the country rock. Neither the old City of Hobart, New Golden Gate, North Golden Gate, or Old Boys' mines have had any trouble with it, and it seems generally easily kept down by baling without requiring special pumps.

The Mathinna gold-field until lately had only been tested in a desultory way by picking out the good stone from the outcrops to a shallow depth. Later experience shows this to have been a very poor trial, as it has shown the outcrops not to be a fair sample of the reefs underneath. With the exception of the old City of Hobart mine, which was worked simply to extract a patch of gold without any exploratory work being done along the line of reef, and so courted disaster, no mine on the field had been tested in a practical way to a depth sufficient to found an opinion upon as to the permanency or otherwise of the gold-bearing stone until the New Golden Gate mine was opened. The work of the Golden Stairs and Old Boys' mines is tending to confirm the favourable opinion of the field given by the New Golden Gate's operations, and I do not doubt that if other mines on the field were opened in a miner-like fashion, the district would become a steady gold-producer. What is most required is that a good working capital should be subscribed to be spent in underground work in each mine, and that the shareholders in the companies should realise their responsibilities as mining adventurers and be prepared to go through with the enterprises they undertake.

Alluvial Mining.—In the lower part of Black Horse Gully and in parts of Long Gully a great deal of alluvial mining was done in the earlier days of the field. I have not been able to get any estimate of the amount of gold raised, or the average earnings per man. The amount of ground turned over is, however, very considerable, and must have occupied a large number of men for more than a short period. Local report says that the gravels were on the whole poor, barely giving average wages to the men engaged. The alluvial stuff is not deep as a rule, few of the shafts being over 25 feet in depth, and most of them much less. The gravel was mined out and washed mostly in cradles, no sluicing having been done. As hydraulic sluicing, if water were brought in, could probably be done for not more than one-tenth of the cost of mining and cradling, it seems possible that the ground, which was too poor to work by the old process, could be profitably dealt with if attacked on a larger scale. This has been done over and over again on old goldfields, so that it may be almost said to be a rule that gravels that have been worked over in a primitive way may generally be treated profitably afterwards by hydraulic sluicing. The question appears to me to be well worth serious consideration, taking into account the cost of bringing in water at high pressure, the disposal of tailings, the area and depth of the ground to be sluiced, the average value of the stuff from surface down to bed-rock, and the cost of working. The quantity of available gravel seems to me to warrant the expense of making the preliminary tests which ought to precede setting to work on a large scale. It would be necessary to sink series of shafts all over the ground to be worked in order to find the quantity and value of the stuff that could be obtained, everything raised from each shaft being carefull measured and washed. It could then be readily calculated whether it could be made to pay for hydraulic working.

On the private land (Talbot's estate) between the Mathinna township and the South Esk, I understand that no mining was allowed, and from the boundary line northward is therefore virgin ground. There is every reason to think that the gravel in this portion of the valley of the Esk, at the mouth of the two auriferous gullies of the Black Horse and Long Gully creeks, would contain a good deal of gold, and perhaps enough to pay for hydraulic sluicing. There must be a good deal of gold in the valley of the South Esk also brought down by that river and Dan's Rivulet, as both of these streams run through proved auriferous country, but it is very doubtful if there would be enough to pay for working, the gravel not having been yet sufficiently concentrated by natural causes. There is, nevertheless, a considerable possibility of payable ground being discovered if looked for, and the matter seems to me worth attention. The large amount of water to be encountered in working the river flats would make them difficult to prospect by sinking shafts, and boring with a water-auger or light diamond drill would probably have to be resorted to.

Some years ago, I am told, a survey was made for a water-race to the River Tyne, a branch of the Esk, and it was found that a plentiful supply of water could be brought on to the Mathinna field at a height of over 100 feet above the Esk. The country traversed was reported to be easy, and the estimated cost for a race, from 8 to 10 miles long, was some £3000. I have not been able to get particulars of this scheme, and the above figures may be, and probably are, very inaccurate; but I believe the main fact, that it is possible to bring in a good supply of water from the Tyne at an elevation sufficient for the hydraulic working of the alluvial ground by means of a race about 10 miles long, through fairly easy country, is correct. The reported estimated cost seems to me much too low. Should any such race be seriously contemplated, the great advantage of a considerably higher-level scheme should be also taken into account, one which should give say 120 feet of pressure at the Golden Gate and Mathinna batteries, so as to enable them to be worked by water-power. The saving of cost by using water-power instead of steam for the battery at the New Golden Gate would be so considerable as to make this matter worth consideration by that company in their own interests alone, without any regard to the alluvial workings.

A strong argument in favour of treating the flats by hydraulic sluicing is that there is a very great probability that by doing so payable reefs would be exposed. Those at present known do not sufficiently account for the gold found in the Black Horse Gully, and there may very well be a reef or several reefs still undiscovered in it.

In concluding this Report, I have to say that the managers of the various mines all took very great trouble to afford me all help in their power, and were personally most kind to me. I have also to thank Messrs. Peter Irvine and James M'Murray for valuable information freely contributed by them, and Messrs. H. J. Wise, Henry Simpson, and William Cundy, for reports and plans.

I have, &c.

A. MONTGOMERY, M.A., *Geological Surveyor.*

The Secretary of Mines, Hobart.

THE ORE-DRESSING MACHINERY AT THE NEW TASMANIAN SILVER-MINE, ZEEHAN.

This machinery, being the first of its kind used in Tasmania for treating silver-ores, has attracted unusual attention from engineers and others connected with the Tasmanian silver industry, and the following short and necessarily superficial description of it will probably meet the requirements of those who desire a general idea of the system adopted, and will form a basis for those who contemplate erecting similar machinery.

The ore is first fed into an ordinary stone-breaker (A., Plate 1), which breaks it into pieces varying in size from one cubic inch downward. It then falls upon an inclined shaking-table (B., Plate 1), the upper end of which is perforated for the purpose of allowing all the ore which may already be reduced sufficiently in size to pass through the perforations, and from thence into the jiggers.

The coarser pieces of ore are delivered by the shaking-table into a pair of crushing-rolls (C., Plate 1). These complete the crushing and reduce the ore to the size suitable for treatment in the jiggers.

In practice it is found that a small proportion of the ore gets through the rolls before being reduced to the required size. This is prevented from going to the jiggers by means of a revolving cylindrical iron sieve known as a sizing-trommel (D., Plate 1), which receives all the ore discharged from the crushing-rolls, that which passes through the trommel being fine enough for subsequent treatment in the jiggers, and is carried automatically to the jigger-house, while that which passes *over* the trommel is taken back to the rolls by a self-acting elevator and is recrushed. The ore is now ready for treatment in the jiggers. There are five of these, each divided into six compartments. A sheet of perforated iron is fixed in compartments 1, 2, and 3, and upon this is laid a bedding of clean galena about one inch thick and made up of fragments just too large to pass through the perforations.

A stream of water constantly flows in at one end of the jigger and out at the other, thus keeping up a continuous horizontal movement, and a jigging (rising and falling) motion is imparted to the water by means of plungers placed in compartments 1A, 2A, and 3A.

The ore, which has previously been sized in a trommel or a classifier, is now fed in at compartment 1 and drops into the agitated water. The best of the ore being heaviest falls to the bedding, intermingles with it, and finally passes through the perforated iron plate and is discharged as clean ore through the bottom of the jigger. The lighter part, consisting of easily separated gangue, is carried by the current of water to the tailing-box; while the medium weight stuff, which consists of a mixture of galena, zinc blende, and iron pyrites, is arrested in compartment No. 2, in which the jigging motion of the water is more gentle and the bedding a little thicker. Here the galena is separated from the blende and pyrites, the former passing through the bedding and the perforated iron, whilst the foreign matter is carried to compartment No. 3, where it is similarly treated and deprived of any galena which may still be mixed with it.

It is lastly washed off as tailings, and by the time it has passed through the three compartments it carries only a minute proportion of galena.

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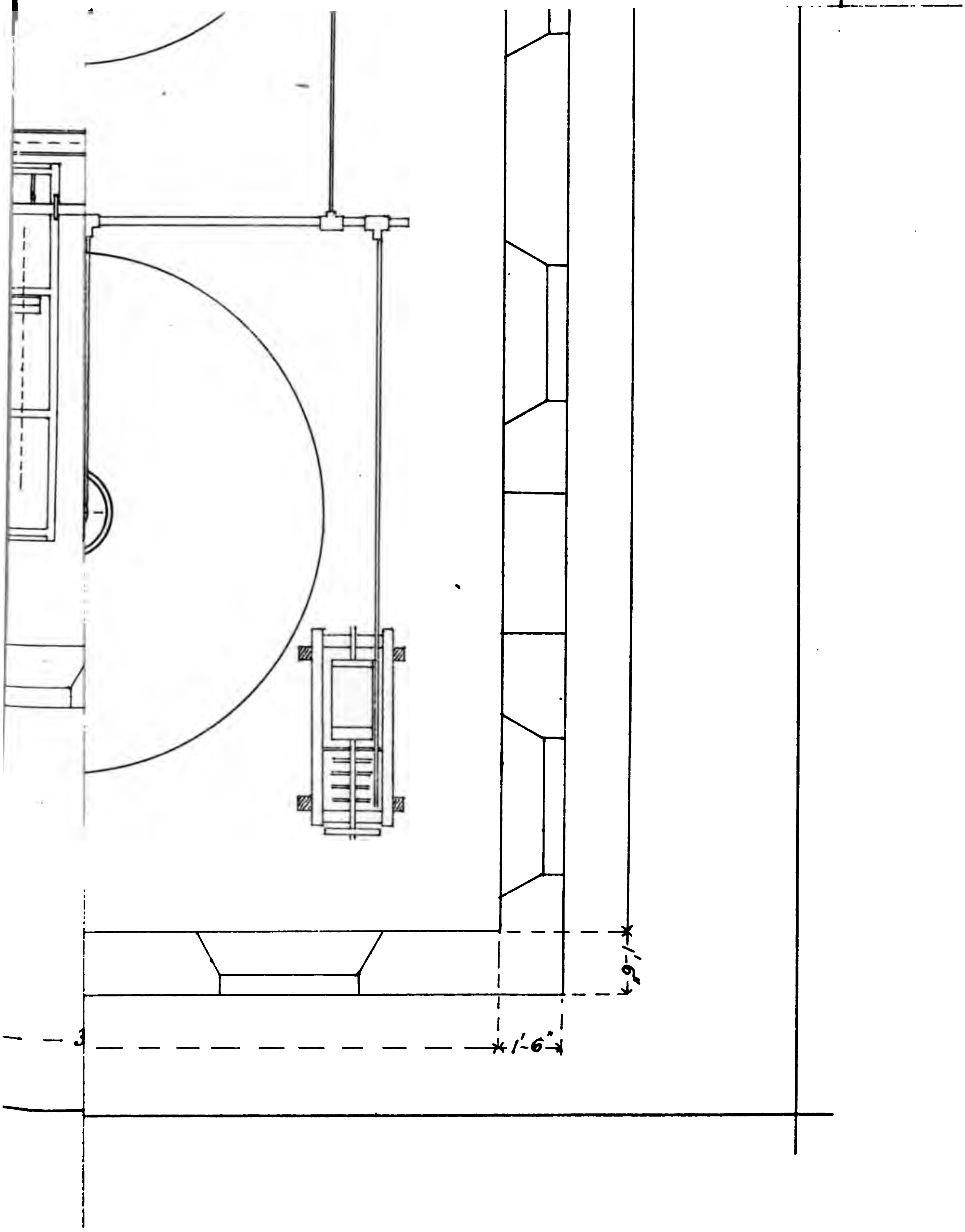

If it is desired to save the blende and pyrites as by-products, the stroke of the plungers can be so arranged as to save clean galena in compartment No. 1, a mixture of galena, blende, and pyrites in No. 2, and blende and pyrites in No. 3; but the writer does not advocate this style of machinery for effecting a clean separation of blende from pyrites. Each jigger completes its own work, and acts independently of the others. The operations carried on in each are similar, the coarsest stuff being treated in the first jigger, and each one in succession being fed with finer stuff than the one before.

To get a maximum amount of work out of the jiggers it is essential to feed them regularly and with as near an uniform size as possible. To effect this the coarser stuff is sized by trommels, and the finer by conical classifiers.

A trommel is simply a cylindrical sieve and requires no description. A classifier is a vessel like a large funnel; an upward jet of clean water is introduced at the bottom of the classifier, whilst water containing fine ore in suspension flows in at the top. The heavier part of the ore resists the upward current and falls near the bottom of the classifier, where there is a place for its exit, while the lighter and finer stuff passes forward to the next classifier, which is larger, and in which the upward current is less strong.

Three of such classifiers separate all the fine ore from the slimes; the former is treated in the jiggers, and the slime is dressed in the ordinary well-known cradle.

The capacity of this plant varies with the class of ore under treatment. The ore from one part of the New Tasmanian Silver Mine, in which the gangue is silica, can be treated at the rate of 20 tons in eight hours, while that from another part of the mine, in which the gangue is composed mainly of blende and pyrites, requires nearly double the time.

The power for driving the machinery is furnished by a 10-inch horizontal engine, and the steam-pressure used is 60 lbs. per square inch.

The whole of the machinery was made and supplied by Mr. Geo. Green, of Aberystwith, North Wales, who makes a speciality of ore-dressing machinery, and who has for many years enjoyed a high reputation for his success in this important branch of engineering work.

RICHARD PROVIS, *A.M.I.C.E.*

(No. 79.)

DIAMOND DRILLS.

Statement of Work done to June 30th, 1892.

Year.	*Locality.*	*Direction of Bore.*	*No. of Bores.*	*Total Distance bored.*	*Average Cost per foot, inclusive of Labour & Fuel.*
	No. 1 Drill.			feet.	£ s. d.
1882–3	Back Creek—For Gold	Vertical	7	1330	0 10 9
1883...	Lefroy—For Gold	Ditto	4	1011	0 5 3
1884...	Tarleton—For Coal	Ditto	1	401	0 5 6
1886...	Longford—For Coal	Ditto	2	1585	0 4 0½
1886–7	Harefield Estate—For Coal	Ditto	1	725	0 6 5
1887...	Cardiff Claim, Mount Malcolm—For Coal	Ditto	1	562	0 17 11¾
1888...	Killymoon Estate—For Coal	Ditto	1	504	0 4 7¾
1888–9	Seymour—For Coal	Ditto	5	2266	0 7 8½
1889 1890	Beaconsfield (Phœnix G. M. Co.)—For Gold	Ditto	1	781	2 0 2
1890...	Beaconsfield (East Tasmania G. M. Co.)—For Gold	Ditto	1	978	0 14 9½
1891...	Spring Bay—For Coal	Ditto	4	937	0 6 10
1891...	Ravensdale—For Coal	Ditto	1	114	0 11 1½
1891–2	Back River, Prosser's Plains—For Coal ...	Ditto	2	854	0 6 1¾
1892...	Lefroy—For Gold	Ditto	2	249	In progress.
	Total	...	33	12,297	
	No. 2. Drill.				
1882...	Beaconsfield—For Gold	Horizontal, underground	1	68	No record.
1883...	Mangana—For Gold	Ditto	1	546	0 15 1
1884...	Guy Fawkes Gully, near Hobart—For Coal	Vertical	1	612	0. 5 6
1885...	Malahide Estate, Fingal—For Gold	Ditto	5	1397	0 5 6
1886...	Carr Villa, near Launceston—For Coal	Ditto	1	571	0 5 4
1886–7	Waratah—Mt. Bischoff Alluvial T.M. Co.—For Tin	Ditto	7	1548	0 6 1½
1887...	Waratah—Mt. Bischoff T.M. Co.—For Tin	Ditto	7	841	0 11 8
1887...	Ditto—Ditto	Horizontal, underground	1	53	0 7 8
1888...	Old Beach—For Coal	Vertical	1	593	abt. 0 10 9
1888...	Campania—For Coal	Ditto	1	600	0 7 7½
1888...	Richmond—For Coal	Ditto	1	500	0 5 1¾
1889...	Back Creek—For Gold	Ditto	4	787	0 8 5⅓
1891...	Macquarie Plains—For Coal	Ditto	2	989	0 4 5½
1891...	Jerusalem—For Coal	Ditto	1	344	0 4 9½
1892...	Langloh Park—For Coal	Ditto	2	462	In progress.
	Total	...	36	9911	

Aggregate number of bores		69
Total distance bored	feet	22,208

A. MONTGOMERY, M.A., *Geological Surveyor.*

Launceston, 4th August, 1892.

No. 1 DIAMOND DRILL.

Report of Strata passed through in boring for Coal at Ravensdale.

Bore commenced 7th August, 1891; finished 27th August, 1891.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface soil	6	0	6	0
Brown and bluish quartzose sandstones	31	0	37	0
Hard brittle grey, green, and brown quartzose sandstones, lower parts showing vertical fractures and very hard; bad boring	50	0	87	0
Hard altered shales (hornstone), extremely dense and hard at the bottom of the bore	26	9	113	9

No. 1 DIAMOND DRILL.

Report of Strata passed through in boring for Coal at the Back River, Prosser's Plains.

No. 1 Bore.

Commenced 15th September, 1891; finished 7th November, 1891.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface soil	6	0	6	0
Soft brown sandstone	35	6	41	6
Firm white and grey quartzose sandstone	48	6	90	0
Blue shale	1	0	91	0
White quartzose sandstone, with micaceous layers	84	3	175	3
Light grey sandy shale	19	9	195	0
Greenish grey and white quartzose sandstone	51	0	246	0
Arenaceous shale	18	0	264	0
Greenish grey quartzose sandstone	67	10	331	10
Hard quartzose sandstone	20	8	352	6
Mud shale with minute marine fossils	29	0	381	6
Hard greenish shale with veins of calcite and vertical fracture	24	6	406	0
Hard dark arenaceous shale	8	2	414	2

No. 2 Bore.

Commenced 30th November, 1891; finished 2nd February, 1892.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Reddish sand } Surface shaft	18	0	18	0
Greenstone gravel	13	0	31	0
White and brownish quartzose sandstones	4	6	35	6
Grey shale	0	8	36	2
Brown quartzose sandstones	1	7	37	9
Greyish and dark shales	15	6	53	3
Grey quartzose sandstone	0	6	53	9
Dark and grey shale	10	0	63	9
Hard grey quartzose sandstone	14	10	78	7
Dark and grey shales	14	5	93	0
Greenish grey arenaceous shale	5	6	98	6
Bluish and reddish shale	13	11	112	5
Grey quartzose sandstone	1	0	113	5
Grey and red shales with sandy bands	30	4	143	9
Grey quartzose sandstone	5	0	148	9
Grey shale with a few carbonaceous markings	1	10	150	7
Grey arenaceous shale	30	8	181	3
White qurrtzose sandstone	37	2	218	5
Grey shale	1	6	219	11
White quartzose sandstone	1	6	221	5
Grey arenaceous shale	16	8	238	1
White and grey quartzose sandstones with occasional mud pebbles	97	11	336	0
Dark shale	0	6	336	6
White quartzose sandstones with a few mud pebbles	8	7	345	1
Grey shale	2	6	347	7
Grey quartzose sandstone with vertical fracture; bad boring	21	6	369	1
White mudstone with vertical fractures	4	7	373	8
Grey, green, and brown quartzose sandstones with vertical fracture, brittle; bad boring	63	1	436	9
Dense fine grained greenstone (diabase) with veins of calcite	3	0	439	9

No. 1 DIAMOND DRILL.

Report of Strata passed through in boring for Alluvial Gold at Lefroy.

BORE No. 1.

Bore commenced 23rd April, 1892; finished 6th June, 1892.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface shaft	11	4	11	4
Scoriaceous vesicular basalt	24	10	36	2
Basalt, more solid	16	6	52	8
Vesicular basalt	36	7	89	3
Hardened brown fine sand	4	0	93	3
Hard vesicular basalt	11	2	104	5
Dark brown compacted fine sand	4	6	108	11
Whitish grey compacted fine sand	2	8	111	7
Soft scoriaceous basalt	6	2	117	9
Brown sandy clay	2	11	120	8
Grey sandy clay	1	0	121	8
Compacted coarse and fine sand and fine gravel with peaty markings	2	3	123	11
Greyish sandy clay with peaty markings	8	0	131	11
Brown compacted fine sand and mud with carbonaceous markings	12	5	144	4
Basalt, partly vesicular	28	4	172	8
Brown compacted fine sand and mud	2	9	175	5
Light-coloured bluish slate (bottom)	15	1	190	6

BORE No. 2.

Bore commenced 16th June, 1892. Still in progress. Depth 58 feet 8 inches, through scoriaceous basalt on 30th June.

No. 2 DIAMOND DRILL.

Report of Strata passed through in boring for Coal at Macquarie Plains.

BORE No. 2.

Commenced 15th June, 1891; finished 15th July, 1891.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Strata previously reported, section appended to Secretary of Mines' Annual Report for 1890-1891	...		306	9
Grey sandstone	39	4	346	1

No. 2 DIAMOND DRILL.

Report of Strata passed through in boring for Coal at Jerusalem.

Bore commenced, 18th August, 1891; finished, 30th September, 1891.

Strata.		Thickness.		Total Depth.	
		ft.	in.	ft.	in.
Surface shaft, hard cemented gravel		37	6	37	6
Coarse grey felspathic or tufaceous sandstone, with carbonaceous markings		22	11	60	5
Light grey shale		3	9	64	2
Grey tufaceous sandstone with mud pebbles and carbonaceous markings		13	8	77	10
Grey clod showing fossil plants		3	0	80	10
Grey tufaceous sandstone with coaly markings		14	11	95	9
Coal, No. 1 Seam		3	0	98	9
Grey tufaceous sandstone		16	10	115	7
Grey shale with fossil plants		4	6	120	1
Grey tufaceous sandstone with carbonaceous markings		21	1	141	2
Hard grey sandstone, with calcite veins and carbonaceous markings		5	2	146	4
Dark clod with carbonaceous streaks		0	8	147	0
Coal	No. 2 seam.	0	1	147	1
Dark clod		0	5½	147	6½
Coal		0	0½	147	7
Dark clod with coaly streaks		1	9½	149	4½
Coal		0	10½	150	3
Band		0	0½	150	3½
Coal		1	8	151	11½
Grey clod and tufaceous sandstone		8	2	160	1½
Coal	No. 3 seam.	1	8	161	9½
Band		0	9	162	6½
Coal		0	5	162	11½
Fine grey tufaceous sandstone		2	6	165	5½
Grey clod		2	10	168	3½
Coarse grey tufaceous sandstone with a few veins of calcite, and carbonaceous markings		58	8	226	11½
Coal, No. 4 seam		0	4	227	3½
Grey clod with fossil plants and calcite veins		7	8	229	11½
Fine-grained sandstone, hard and splintery, with calcite veins		6	8	241	7½
Coarse felspathic sandstone with specks of carbonaceous matter		25	6	267	1½
Black shale with cubical iron pyrites		0	4	267	5½
Grey tufaceous sandstone with specks of carbonaceous matter		22	5	289	10½
Dark shale, hard boring		7	6	297	4½
Black siliceous fine-grained sandstone		3	0	300	4½
Black clod showing fossil plants		4	0	304	4½
Grey tufaceous sandstone with carbonaceous markings		25	8	330	0½
White calcareous shale, harp and brittle, with plant impressions		7	0	337	0½
Hard greenstone, fine-grained at top, a little coarser in grain at bottom		6	10	343	10½

Analysis of Coal from Jerusalem Bore, made by W. F. Ward, *Esq., Government Analyst, 25th September,* 1891.

	No. 1 Seam.	No. 2 Seam.	No. 3 Seam.
Fixed carbon	42·3 per cent.	50·7 per cent.	33·9 per cent.
Loss at red heat	26·9 „	28·3 „	29·1 „
Mineral matter (ash)	22·4 „	16·4 „	34·4 „
Moisture	8·4 „	4·6 „	2·6 „

In No. 1 Seam the Foreman reported that the greater part of the best coal broke up and would not form a core. The quality of the seam as a whole is probably better, therefore, than is shown by the above analysis.

No. 2 DIAMOND DRILL.

REPORT of Strata passed through in boring for Coal at Langloh Park.

Bore No. 1.

Commenced, 26th April, 1892; finished, 16th May, 1892.

Strata.	Thickness.		Total Depth.	
	ft.	in.	ft.	in.
Surface soil and clay	16	0	16	0
Brown tufaceous sandstone, hard, brittle, and full of fractures	34	8	50	8
Grey tufaceous sandstone	2	0	52	8
Very black clod	0	10	53	6
Coal, with ¼ inch band of clod at 54′ 6″	1	1	54	7
Dark fireclay	2	6	57	1
Grey tufaceous sandstone, with occasional coal markings, getting harder with depth, very hard at 98 feet and downwards	58	5	115	6
Diabase greenstone	5	2	120	8

Bore No. 2.

Commenced, 23rd May, 1892; finished, 2nd July, 1892.

Strata.		Thickness.		Total Depth.	
		ft.	in.	ft.	in.
Surface soil		4	0	4	0
Hard brown tufaceous sandstone		22	0	26	0
Grey tufaceous sandstone with occasional hard bars		39	5	65	5
Greenish-coloured shale		4	7	70	0
Mixed shale and tufaceous sandstone		26	0	96	0
Clean tufaceous sandstone		12	6	108	6
Fireclay		0	5½	108	11½
Coal	No. 1 Seam	0	1½	109	1
Fireclay		0	3½	109	4½
Coal		2	8	112	0½
Band		0	2	112	2½
Coal		1	3	113	5½
Fireclay band		0	6½	114	0
Coal		3	1	117	1
Fireclay		3	10½	120	11½
Coal	No. 2 Seam	1	3	122	2½
Band		0	1¼	122	3¾
Coal		0	5	122	8¾
Band		0	0½	122	9¼
Coal		1	7½	124	4¾
Band, black clod		0	4½	124	9¼
Coal		0	10	125	7¼
Fireclay		5	11¼	131	6½
Coal	No. 3 Seam	0	6½	132	1
Band		0	0½	132	1½
Coal		1	7	133	8½
Dark shale, with plant impressions		1	3	134	11½
Fine grained tufaceous sandstone		5	0½	140	0
Blue shale, with fern impressions		5	6	145	6
Grey tufaceous sandstone, with occasional coal markings		36	2	181	8
Tufaceous sandstone, with streaks of coal		1	4	183	0
Mixed shale and tufaceous sandstone		0	11	183	11
Dark shale		0	2½	184	1½
Coal—No. 4 Seam		1	3½	185	5
Light and dark shales		1	6	186	11
Grey tufaceous sandstone		21	7	208	6
Sandstone, full of coaly matter		2	0	210	6
Dark tufaceous sandstone		3	0	213	6
Grey tufaceous sandstone, with hard bars at 250 and 258 feet		54	0	267	6
Mixed shale and tufaceous sandstone, with streaks of coal		1	0	268	6
Clod, with streaks of coal		0	10	269	4
Coal	No. 5 Seam	1	5	270	9
Dark band		0	8½	271	5½
Coal		1	11	273	4½
Hard clod		0	2½	273	7

BORE NO. 2—*continued.*

Strata.	Thickness.	Total Depth.
	ft. in.	ft. in.
Hard dark fireclay	6 6	280 1
Dark tufaceous sandstone, with coal streaks	17 11	298 0
Black clod, with fern impressions	9 0	307 0
Coal	0 1¼	307 1¼
Black clod	1 10¾	309 0
Mixed shale and tufaceous sandstone	9 3	318 3
Coal	0 5	318 8
Hard black shale, with fern impressions	4 9	323 5
Dark sandstone, with white veins	14 7	338 0
Hard altered sandstone	1 5	339 5
Hard diabase greenstone	2 0	341 5

Analysis of Coal from No. 2 bore, Langloh Park, by W. F. Ward, Esq., Government Analyst.

	No. 1 Seam.	No. 2 Seam.	No. 3 Seam.	No. 5 Seam.
Fixed carbon	55·9	62·4	42·5	52·6
Matter volatile at red heat	18·0	20·5	21·2	9·9
Mineral matter (ash)	21·4	13·0	31·0	34·0
Moisture lost at 212° Fah.	4·7	4·1	5·3	3·5
	100·0	100·0	100·0	100·0

A. MONTGOMERY, *M.A.*, *Geological Surveyor.*

No. 1.

COMPARATIVE Statement of Gold won during the Years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, *and the first Half-year of* 1892.

YEAR.	QUANTITY.	VALUE.
	ozs. dwts.	£
1880	52,595 0	201,297
1881	56,693 0	216,901
1882	49,122 6	187,337
1883	46,577 10	176,442
1884	42,339 19	160,404
1885	41,240 19	155,309
1886	31,014 10	117,250
1887	42,609 3	158,533
1888	39,610 19	147,154
1889	32,332 13	119,703
1890	20,510 0	75,888
1891	38,789 0	145,459
For the first half-year of 1892	22,240 0	83,400

No. 2.

***RETURN** showing the Quantity of Gold obtained from Quartz during the Years* 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, *and the first Half-year of* 1892.

YEAR.	QUANTITY.	VALUE.
		£
1880	34,345 ounces	130,622
1881	45,776 „	174,956
1882	36,215 „	137,183
1883	36,672 „	138,060
1884	30,540 „	114,630
1885	33,266 „	124,234
1886	25,004 „	87,516
1887	33,427 „	123,453
1888	34,156 „	126,139
1889	33,069 „	116,517
1890	17,829 „	64,184
1891	33,659 „	126,221
For first half-year of 1892	17,590 „	65,962

No. 3.

***COMPARATIVE** Statement of Tin exported from Tasmania during the Years.* 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, *and for the first Half-year of* 1892, *compiled from Customs Returns only.*

YEAR.	TONS.	VALUE.
		£
1880	3954	341,736
1881	4124	375,775
1882	3670	361,046
1883	4122	376,446
1884	3707	301,423
1885	4242	357,587
1886	3776	363,364
1887	3607½	409,853
1888	3775¼	426,321
1889	3764	344,941
1890	3209¼	296,368
1891	3235	291,715
For first half-year of 1892	1486½	135,128

No. 4.

***QUANTITY** and Value of Coal raised during the Years* 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, *and first Half-year of* 1892.

YEAR.	QUANTITY.	VALUE.
	TONS.	£
1880	12,219	10,998
1881	11,163	10,047
1882	8803	7923
1883	8872	7985
1884	7194	6475
1885	6654	5989
1886	10,391	9352
1887	27,633	24,870
1888	41,577	37,420
1889	36,700	33,030
1890	50,519	45,467
1891	43,256	38,930
For first half-year of 1892	18,658	16,792

No. 5.

***RETURN** showing the Number of Persons engaged in Mining during the Years* 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, *and first Half-year of* 1892.

YEAR.	NUMBER.
1880	1653
1881	3156
1882	4098
1883	3818
1884	2972
1885	2783
1886	2681
1887	3361
1888	2989
1889	3141
1890	2868
1891	3219
For first half-year of 1892	3139

No. 6.

***RETURN** showing the Number and Area of Leases held under "The Mineral Lands Act" and "The Gold Fields Regulation Act," in force on* 30th *June of each Year since* 1887.

Nature of Lease.	In force on 30th June, 1887.		In force on 30th June, 1888.		In force on 30th June, 1889.		In force on 30th June, 1890.		In force on 30th June, 1891.		In force on 30th June, 1892.	
	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.	NO.	AREA.
		Acres.		Acres.		Acres.		Acres.		Acres.		Acres.
Under "The Mineral Lands Act," for tin, &c., at a rental of 5*s.* an acre	656	22,892	957	32,231	1497	53,251	1303	49,463	1495	67,216	1857	89,962
For coal and slate, at 2*s.* 6*d.* an acre rent	62	10,665	41	6045	38	4499	51	7636	45	7255	47	6874
Under "The Gold Fields Regulation Act," at a rental of 20*s.* an acre	149	1474	285	2812	270	2687	325	3088a. 2r. 20p.	245	2366a. 2r. 10p.	489	4606
Water Rights and Mining Easements	107	773 sluice-heads.	140	852 sluice-heads.	204	1005 sluice-heads.	209	950 sluice-heads.	200	998 sluice-heads.	173	812 sluice-heads.

No. 7.

***RETURN** of the Number and Area of Leases under "The Mineral Lands Act" and "The Gold Fields Regulation Act," in force on the* 1st *July,* 1891, *issued during the Year ending* 30th *June,* 1892, *cancelled during the Year ending* 30th *June,* 1892, *and remaining in force on* 30th *June,* 1892.

Nature of Lease.	In force on 1st July, 1891.				Issued during Year ending 30th June, 1892.				Cancelled during Year ending 30th June, 1892.				In force on 30th June, 1892.			
	NO.	AREA.			NO.	AREA.			NO.	AREA.			NO.	AREA.		
		A.	R.	P.		A.	R.	P.		A.	R.	P.		A.	R.	P.
Under "The Mineral Lands Act," for tin, &c., at a rental of 5*s.* an acre	1495	67,216	0	0	724	36,599	0	0	372	13,763	0	0	1857	89,962	0	0
For coal and slate, at 2*s.* 6*d.* an acre rent	45	7255	0	0	14	1879	0	0	12	2360	0	0	47	6874	0	0
Under "The Gold Fields Regulation Act," at a rental of 20*s.* an acre	245	2336	2	10	286	2696	0	0	42	424	2	10	489	4606	0	0
Water Rights and Mining Easements	200	998 sluice-heads			16	17 sluice-heads			33	193 sluice-heads			173	812 sluice-heads		

No. 8.

COMPARATIVE Statement of Net Revenue from Mines, being Rents, Fees, &c. paid to the Treasury.

YEAR.	AMOUNT.			YEAR.	AMOUNT.		
	£	s.	d.		£	s.	d.
1880	8944	5	11	1886	12,523	10	4
1881	20,936	5	5	1887	14,611	11	5
1882	23,077	1	9	1888	23,502	8	4
1883	15,439	14	5	1889	17,254	9	0
1884	6981	11	10	1890	26,955	4	9
1885	11,070	5	7	1891	37,829	16	5

The above Statement does not include Stamp Duties upon Transfers of Leases and Registration of Companies, or the Tax payable upon Dividends, from which sources large sums are derived.

No. 9.

RETURN of Dividend Tax paid by Gold Mining Companies.

YEAR.	NO. OF COMPANIES.	AMOUNT OF DIVIDEND.			AMOUNT OF TAX.		
		£	s.	d.	£	s.	d.
1880	5	65,852	17	2	2467	16	0
1881	4	99,250	0	0	3721	17	6
1882	5	55,825	0	0	2093	8	9
1883	5	63,168	10	0	2368	16	4
1884	4	39,400	0	0	1477	10	0
1885	2	61,250	0	0	2296	17	6
1886	3	41,125	0	0	1542	3	9
1887	2	66,750	0	0	2503	2	6
1888	2	65,375	0	0	2451	11	3
1889	4	28,000	0	0	1050	0	0
1890	3	13,609	0	0	510	6	9
1891	3	35,200	0	0	1320	0	0
1892, first half of	5	21,750	0	0	815	13	3

No. 10.

RETURN of Dividend Tax paid by Tin Mining Companies.

YEAR.	NO. OF COMPANIES.	AMOUNT OF DIVIDEND.			AMOUNT OF TAX.		
		£	s.	d.	£	s.	d.
1880	11	64,755	0	0	2428	6	3
1881	13	102,418	0	0	3840	13	6
1882	12	108,935	0	0	4085	1	3
1883	9	98,837	2	6	3706	7	9
1884	4	60,169	0	0	2256	6	9
1885	4	92,644	0	0	3474	3	0
1886	5	108,849	10	0	4081	17	1
1887	6	128,753	0	0	4828	4	8
1888	10	148,638	17	2	5573	19	10
1889	6	100,850	0	0	3781	17	6
1890	10	87,187	10	1	3269	11	1
1891	8	83,598	1	6	3134	0	0
1892, first half of	5	37,700	3	3	1413	15	1

No. 11.

RETURN of Dividend Tax paid by Silver-Lead Mining Companies.

YEAR.	NO. OF COMPANIES.	AMOUNT OF DIVIDEND.			AMOUNT OF TAX.		
		£	s.	d.	£	s.	d.
1891	4	10,360	0	0	388	10	0
1892, first half of	3	8584	14	0	321	18	0

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